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STUDY OF THE ECONOMIC IMPACT OF SULFUR REGULATIONS PROMULGATED BY THE U.S. ENVIRONMENTAL PROTECTION AGENCY FOR OHIO ON AUGUST 27, 1976

STUDY DOCUMENT NUMBER 4. INDUSTRY IMPACT ANALYSIS STATEMENT ON SULFUR OXIDE REGULATIONS FOR OHIO

Energy and Environmental Analysis, Incorporated,
Arlington, Virginia

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Industry Impact Analysis
Statement on
Sulfur Oxide Regulations
For Ohio

Part of a Study of the Economic Impact
of Sulfur Regulations Promulgated by
the U.S. Environmental Protection Agency
for Ohio on August 27, 1976

Prepared for:

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16. ABSTRACT

This report is the fourth volume in support of the Inflation Impact Statement for sulfur dioxide regulations prepared by the U.S. Environmental Protection Agency, to correct deficiencies in the Ohio State Implementation Plan. The Technical Support Document, Volumes I and II may be obtained through the National Technical Information Service - EPA 905/2-76-002, PB-257 694 and PB-257 695.

This document presents the evaluation of the economic impact of the sulfur oxide regulations in Ohio focused on 302 manufacturing plants and institutional establishments. Of the plants reviewed three-quarters of the plants were boilers while the remainder were general process fuel burners such as cement plants, chemical processes and fuel gas burning industrial processes.

PRICES SUBJECT TO CHANGE

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Cements		Utility Impacts	13B
Chemical Industry		Industrial Impacts	
Gas Burners		Energy Impacts	
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EXECUTIVE SUMMARY

A. Introduction

This section presents the summary results of an evaluation of compliance status, costs, and economic impacts of the proposed and final sulfur oxide regulations on Ohio industrial establishments.

The evaluation of the economic impact of the sulfur oxide regulations in Ohio focused on 302 manufacturing plants and institutional establishments (universities, hospitals, etc.). Excluded from coverage were plants which burned natural gas exclusively as well as those for which current sulfur emissions were negligible. Roughly three-quarters of the plants reviewed in this study were boilers while the remainder were general process fuel burners such as cement plants, chemical processes such as sulfuric acid and fuel gas burning industrial processes (oil refineries and steel plants).

B. Costs and Compliance

1. Compliance Status

a. Proposed Regulations

Of the 302 plants covered in this study 128 appear to be out of compliance with the proposed regulations. As might be expected, one-half of these plants are in five energy intensive industry sectors: primary metals, chemicals, petroleum refineries, rubber and paper. Two-thirds of the non-complying plants are located in Ohio's thirteen urban counties, primarily in Cuyahoga, Franklin, Stark and Summit counties.

b. Final Regulations

Under the revised regulations 113 plants appear to be out of compliance. 83 percent of the non-complying plants are located in the urban counties, reflecting the increased stringency of regulations applying to boilers in urban areas and the relaxation of regulations in rural counties in comparison to the proposed regulations.

2. Annual Costs[1/]

Table 1 presents the annual costs of compliance under both proposed and final regulations. The cost drops from nearly $50 million to $41 million under the revised regulations. The distribution of cost impacts among industries, shown in Table 2, indicates that petroleum refining, primary metals, chemicals and institutions account for over 80 percent of the cost impacts under both sets of regulations. The most significant difference between the proposed and final regulations can be seen in Table 3 which shows cost impacts by type of industrial installation. The share of annual costs borne by boilers increases from 40 percent under the proposed regulations to 70 percent under the final regulations reflecting the increased stringency of emission limits applying to steam generating facilities in urban areas under the final regulation.

3. Capital Costs

Table 1 shows that capital costs fall from $67 million (in 1975 prices) under the proposed regulations to $52 million under the final regulations. Under the proposed regulations, industry specific process regulations applicable to steel mills, petroleum refineries and sulfuric acid plants account for all capital costs since low sulfur coal is projected to the exclusive control strategy adopted by boiler and fuel combustion process installations.

1/ Includes annualized capital charges plus fuel and other operating costs, and a rate of return on equity.

TABLE 1

INDUSTRIAL
COSTS OF SULFUR OXIDE REGULATIONS

(Millions of 1975 Dollars)

Alternatives	Capital Costs	Annual Costs
(1) Proposed	66.6	49.5
(2) Final	51.9	41.2
Cost Reduction	14.7	8.3

TABLE 2

DISTRIBUTION OF ESTIMATED ANNUAL COSTS OF INDUSTRIAL COMPLIANCE

Industrial Category	Percent of Total Annual Cost	
	Proposed Regulation	Final Regulation
Chemicals	28.3	30.2
Primary Metals	34.5	32.9
Petroleum Refining	7.8	7.3
Stone, Clay and Glass	7.4	0.0
Institutions	6.0	10.1
Subtotal	84.1	80.5
Other Sectors	15.9%	19.5%

TABLE 3

ANNUAL COSTS OF PROPOSED AND FINAL REGULATIONS BY TYPE OF INDUSTRIAL INSTALLATION

(% of Annual Costs)

	Proposed Regulation	Final Regulation
Type of Installation	% of Total Annual Cost	% of Total Annual Cost
Boilers	46.2	67.8
General Processes	7.4	.7
Chemical Processes	10.3	6.5
Fuel Gas Burning Processes	36.2	25.1
TOTAL	100.0	100.0

Under the final regulations, capital costs decline due to less stringent regulations on industry specific processes. In addition, boilers and general process sources account for approximately 25 percent of the capital costs.

C. Industry Impacts

1. Prices

Production and related employment impacts can result from the costs of complying with sulfur oxide regulations if the resultant product price increases at affected plants lead to plant shutdowns and production curtailment. The average price increase due to control costs for all industry or even by industrial categories is estimated to be negligible (far less than 1 percent) since many plants are in compliance and incur no cost or price increases at all. Consequently, the analysis focused on the distribution of price impacts within industry among the affected plants.

a. Proposed Regulations

Most of the plants out of compliance with the proposed regulation are estimated to experience price increases below 1 percent. A substantial price increase was estimated for 20 plants representing 12 manufacturing plants and 8 institutions shown in Table 4.

Although the magnitude of these price impacts estimated to occur under the proposed regulations may lead to substantial output and employment effects, time constraints did not permit a followup analysis of these impacts.

b. Final Regulations

Nearly all of the plants that are out of compliance under the final regulation experience price increases of less than 1 percent.

TABLE 4

PRICE IMPACTS FOR INDUSTRIAL INSTALLATIONS[1/]

PROPOSED AND FINAL REGULATION

INDUSTRY	PROPOSED PERCENT INCREASE	FINAL PERCENT INCREASE
Sulfuric Acid	5-23	3-20
Cement	1-5	-
Rubber Products	1-10	-
Institutions	1-12	>5

1/ Assumes 100% of the cost increases are passed on to consumers.

The only substantial price impacts were those experienced by four sulfuric acid plants (averaging 10 percent) and by two government installations where fuel cost increases would cause current budget requirements to rise by more than 5 percent shown in Table 4.

Industrial sectors for which price increases below 1 percent were incurred are not expected to experience measurable production or employment affects.

2. Sulfuric Acid Industry Impact Analysis

The capital costs of installing pollution abatement systems on sulfuric acid plants in Ohio exceeded $7 million and the resultant price increases for the affected plants ranged from 1-20 percent.

However, it appears unlikely that the sulfuric acid industry in Ohio will be seriously impacted by the final EPA regulations.

The four affected Ohio sulfuric acid plants employ approximately 420 workers, averaging 105 workers per plant. In total numbers, any employment impact would affect only a small number of employees and less than 1 percent of all employees in the state.

Transportation costs for sulfuric acid tend to be very high in relation to product price, leading to a marketing structure where consumers are typically within 200 miles of the supplying plant. The most likely alternative supplies of sulfuric acid which could capture Ohio markets as a consequence of abatement costs incurred by Ohio producers are plants in neighboring states. Transport costs from these states to Ohio markets range from $7-26 per ton of acid. If the industry is competitive within Ohio, these transport cost differentials appear to overshadow the $1-6 per ton price increases projected to occur in order to comply with Ohio emission regulations. Furthermore, neighboring states are also subject to a similar range of sulfur emission limits and associated control costs which would further serve to protect the markets of sulfuric acid plants in Ohio. One possible source of competition is Canadian imports, although precise effects of such impacts would not be evaluated within the time frame of this study.

Another potential threat to the markets of Ohio sulfuric acid industry might be for the consumers themselves to build sulfur processing facilities.1/ This threat, however, seems highly unlikely due to the high capital costs of these plants (in relation to sales) and the fact that such plants would have to comply with Federal New Source Performance Standards which are more stringent than the final regulations on existing Ohio plants.

Although capital requirements are estimated to be substantial for all the sulfuric acid plants needing control, it appears that these capital costs will have a relatively small impact. Under the proposed regulations 4 companies (owning five plants) incurred capital costs. Under the final regulations, three of the same companies (owning four plants) incurred capital costs. In each case, all but one company were large, diversified corporations for which the capital costs of pollution abatement were far less than 1 percent of total corporate capital expenditures.

For one firm, a single plant corporation, incremental capital costs of compliance probably constitutes a significant percentage increase in investment expenditures.2/ However, this firm has a partially captive market and is already nearing completion of plans to install control equipment that would meet the final USEPA regulations. It appears that no significant impact on investment demand will be felt by sulfuric acid producers as a result of the USEPA regulations.

1/ Effluent guidelines for other industries (e.g., steel) may increase the likelihood of sulfur processing facilities being built as a control strategy for those industries. This may act to reduce demand for existing sulfuric acid plant products.

2/ Corporate financial records for this firm could not be obtained in the time available for this study.

Finally, the most significant factor is that the sulfuric acid plants already appear to have undertaken the necessary compliance steps and have done so in response not to the USEPA regulations, but to the existing state regulation. Therefore, no significant additional impacts of the USEPA regulations on the sulfuric acid industry are expected.

Apparently only one sulfuric acid plant has delayed installation of control systems; the plant has threatened shutdown as of September 1, 1976 unless litigation by the state, based on the plant's violation of the state regulation, is dropped. If that plant does shutdown, its markets could presumedly be captured by other Ohio plants, further reducing the likelihood of any adverse impacts on the other sulfuric acid producers in Ohio.

3. Financial Impacts on Other Industries

a. Proposed Regulations

Analysis of sulfur oxide control equipment needs by industry suggested that plants owned by 16 corporations had capital requirements that appeared to be substantial in relation to normal investment demands. These were with a few exceptions, large integrated companies in the steel, chemical and petroleum refining industries. A more refined comparison of the ratio of added financial requirements to average investment levels over the 1973-75 period[1/] indicated that nine firms would probably experience an increase in total corporate investment as high as 1 percent. These are steel, rubber and sulfuric acid. All others experience impacts of less than 1 percent.

b. Final Regulations

13 plants owned by 9 firms appeared to experience substantial capital investments as a consequence of sulfur emission limits.

[1/] For most industries, the use of these recession years as a basis for calculating "normal" investment levels will tend to overstate the financial impact.

However, incremental capital requirements due to the regulations are expected to account for increases in total corporate investment greater than 1 percent for only three firms. One firm is a sulfuric acid plant which was discussed above. All other firms are steel producers. For all other corporations reviewed, added capital requirements added less than three tenths of 1 percent of recent average levels of investment demand.

The capital costs of installing controls on the impacted steel plants in Ohio will total $9.8 million. Three plants operated by two large integrated steel producers will be impacted. Two plants are expected to comply without difficulty while the third has already experienced difficulty meeting environmental requirements.

One of the steel plants impacted is an older plant in the Mahoning River Valley. Obsolete technology and poor location coupled with significant air and water pollution problems have brought the viability of the plant into question. EPA has studied the problem in detail. Based on these studies, the plant was granted an exemption from the 1977 standards requiring installation of best practicable control technology for reduction of effluent discharges. However, air standards are to be strictly enforced. The remaining two plants are relatively new and should be able to make the necessary expenditures.

Capital availability is not projected to be a constraint for the two companies involved. Capital expenditure projections for 1977 indicate that the required investments will be less than 1 percent of projected expenditures. Improved profitability which began in 1974 coupled with strong domestic growth projections should allow the companies to meet both pollution and expansion requirements without affecting current capital structures.

One old oil refinery was projected to incur substantial control costs in order to comply with sulfur regulations. This plant may be phased out more rapidly in order to avoid the capital investments for pollution control.

SECTION I

INTRODUCTION

Purpose

On November 10, 1976 (40 FR 52510), substitute sulfur dioxide regulations were proposed by the United States Environmental Protection Agency (EPA) for the State of Ohio in the Federal Register. Following public hearings, the proposed regulations were reevaluated to reflect comments made by interested parties. Based on these comments, an attempt was made to refine the air quality analysis and to consider costs to reduce the potential economic impact. Final regulations were promulgated on August 27, 1976 (41 FR363223). This report describes the methodology used in the reevaluation and the economic impact of the proposed and final regulations on industrial sources of sulfur dioxide emissions located in the state of Ohio.

The report is one of ten documents prepared in support of an economic analysis of the regulations proposed for final adoption by the EPA covering stationary sources of SO_2 emissions located in the state of Ohio. These documents contain essential backup information upon which the conclusions contained in the Inflationary Impact Statement (IIS) were drawn. The IIS can be viewed as a summary document which the reader may wish to consult prior to reviewing this report. Appendix F contains a description of these documents, including the backup reports for this industrial impact assessment.

Report Content

This report contains five major sections. Each section is essential to obtaining a full understanding of the scope and methodology employed in the study.

Section II describes the regulations covered and the changes to the regulations proposed on November 15, 1976 that were made in the final regulations.

Section III summarizes the industries located in the state, contrasts Ohio's industrial base with the nation's, and describes the industries that were the primary focus of the analysis.

Sections IV and V, respectively, cover the cost of complying with the proposed regulations and their potential economic impact. The cost analysis provides estimates of both the capital and annualized expenditures required for compliance with the proposed and final regulations. The economic analysis section attempts to translate these costs into expected impacts on product prices, employment and output. An important element of this analysis was the ability of affected industrial sources to finance the required expenditures.

SECTION II

REGULATIONS

The proposed and final regulations for which impacts have been calculated are those rules proposed for Ohio by the Administrator of the Environmental Protection Agency on November 10, 1975 and the regulations which were promulgated on August 27, 1976. The final regulations deviate from the proposed rules as a result of public hearings on those rules and further analysis of data originally used. Both sets of regulations are presented in Appendices A-1 and A-2.

A. Proposed Regulations

The proposed regulations for fossil fuel-fired steam generators specified county-wide emissions standards. Twelve counties received sliding scale regulations limiting emissions to a range of pounds of SO_2 per million BTU's by total rated capacity of heat input. These sliding regulations impose stricter control on the larger sources. In another forty-two counties, the regulations applied were specifically stated in pounds of SO_2 per million BTU's. Such so-called "flat" regulations make no distinctions among sources; all are controlled to the same emission level. The remaining thirty-four counties were left unregulated since sulfur dioxide sources either did not exist or were expected to have an insignificant effect on ambient air quality in those counties.

General industrial processes in 55 counties were given an emission limitation under the proposed regulations. That regulation was

$$E = 19.5\ (P)^{.67}$$

where E = emissions and P= process weight rate in tons/hr.

Apart from those general processes there were the following specific industrial process regulations in those same 55 counties: (1) sulfuric acid production units, 6.5 pounds of SO_2 per ton of acid produced; (2) fuel-gas burning processes, 50 grains H_2S/100 dscf.

B. Final Regulations

The fossil fuel fired boilers are regulated under either flat county-wide limitations or source specific regulations. In 17 cases only a county regulation applied. In 15 other counties a flat regulation is supplemented by source specific emission limitations. 18 counties were given only source-specific regulations with the remaining sources in those counties judged to be insignificant contributors to the area air quality problem.

Industrial processes are no longer under a state-wide regulation. They are regulated by county-specific or source-specific limitations in pounds of SO_2/ton of process weight rate. 63 counties have been left unregulated for industrial processes.

C. Comparison

The proposed regulations were set on the basis of information on one or more sources within the county. The final regulations reflect a more comprehensive study of sources and their locations. They include no regulations which have state-wide application and supplement or replace county regulations with 137 source specific emission limitations, 97 applying to industrial establishments and 40 to utilities. This response to public comment on county and state-wide regulations represents a major change in the nature of the emissions limitations. The kinds of regulations imposed under each set of regulations are shown in Table II-1.

TABLE II-1

SUMMARY OF REGULATIONS

NUMBER OF COUNTIES BY TYPE OF REGULATION

	Proposed Regulations	Final 1/ Regulations
Steam Generation Regulations 2/		
flat	42	27
sliding scale	12	6
source specific	2	36
no regulation	34	36
General Process Regulations 3/		
flat	0	20
sliding scales	55	3
source specific	0	8
no regulation	33	63
Other Process Regulations 3/		
flat	55	9
source specific	0	5
no regulation	33	76

1/ Under Final regulations many counties have more than one type of regulation for the same type of installation. Therefore, sum of counties will be more than the total number of counties in Ohio (88).

2/ These establishments burn fossil fuel for the purpose of generating steam.

3/ These establishments burn either fossil fuel or fuel gas (hydrogen sulfide) to provide direct process heat.

Other changes in the proposed regulations will be discussed in greater detail in other sections. In general, it may be noted that the final regulations are tighter than the proposed regulations in urban areas and more lenient for many rural areas. Likewise, process regulations are, in general, less stringent while steam generation regulations have become more stringent.

SECTION III

COVERAGE OF OHIO INDUSTRY

A. Population in the State

Industry in the state of Ohio is comprised of 16,396 manufacturing establishments, distributed among the twenty Standard Industrial Classification (SIC) categories. (SIC categories are defined in Appendix C-1.)

Ohio represents 5 percent of all such establishments within the United States. The individual SIC's represent up to 10 percent of their respective national total number of establishments.

The value of shipments for Ohio industries totalled $55,056.5 million in 1971, approximately 7 percent of the national value. Individual industries range up to 17 percent of their respective national totals.

Ohio is characterized by heavy industry with 4 industries, primary metals, fabricated metals, machinery and transportation equipment, accounting for over half of the state's total value of shipments.

The counties in which the major urban centers of Akron, Canton, Cincinnati, Cleveland, Columbus, Dayton, Toledo and Youngstown are located account for nearly two thirds of total state establishments. Rural counties (75 of the 88 counties in Ohio) thus account for one-third of industrial establishments.

B. Coverage of Industry in this Study

Table III-I summarizes the total number of industries covered in this study as well as the reasons for not including the entire state-wide total of 16,396 industrial establishments in determining compliance and non-compliance of plants for the regulations.

TABLE III-1

COVERAGE OF PLANTS CONSIDERED FOR DETERMINATION OF COMPLIANCE

	Source Category				
Screening Steps	Fuel Combustion Boilers	Fuel Combustion Processes	Chemical Processes	Fuel Gas Burning Processes	Total
1) Initial Ohio EPA data base which omits all point sources with emissions 10 tons SO_2	361 a/	158 a/	6	18	521 b/
2) Power plants and f/ incinerators	46 power plants	30 incinerators	0	0	76
3) Plants with negligible emissions	64	40	0	0	182 b/
4) Insufficient data	0	61	0	0	61
5) Other	1 c/	0	0	1 d/	2
Total Considered	250	27	6	17	302 e/

---

a/ Includes 22 mixed plants, i.e., plants which contain both boiler and process sources.

b/ Does not sum across due to not double counting the mixed plants.

c/ Plant out of business.

d/ One plant, originally determined to be an oil refinery off-gas burner, has since been determined to contain solely steam generating boilers. It is included in the final count.

e/ This total includes double counting of mixed plants. A count of up to 22 should be removed. A precise count is not attainable.

f/ Power plants were covered in the utility documents. Incinerations were not regulated under this regulation package.

The analysis is concerned only with existing establishments and the data used are for the years 1973-1975 (summarized in Document #9). The baseline emissions for each plant were also projected to the year 1985 by the use of annual growth figures, specific to county and industry type. Their application yields a projection of annual and capital control costs to the year 1985.

1. Ohio EPA Data Base

The data base used in this study was based on the Ohio Environmental Protection Agency point source SO_2 inventory.[1/] This inventory includes point sources which emit 10 tons or more per year of SO_2.

Based on an Ohio EPA publication examining the technical justification for emissions-based cutoff of insignificant sources from the permitting process,[2/] it was determined that a cutoff of 15 tons per year of SO_2 emissions results in an underestimation of capital costs by approximately 5 percent and operating and maintenance costs by about 1 percent. A cutoff of 100 tons produces an underestimation of total capital costs

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1/ Background Document 9. The only exception is the fuel combustion process category where data was obtained from the Ohio inventory developed by U.S. EPA-Region V.

2/ "An Investigation of the technical justification for Emission-Based Cutoff of Insignificant Sources from the Permitting Process," A.B.Clymere, Ohio EPA, December, 1975.

of about 10 percent. Therefore, the data used in this study is the entire emission inventory as provided by Ohio EPA which includes all point sources with emissions of 25 tons or more of SO_2 per year.

The inventory contained 521 plants, approximately 1800 point sources of which approximately 1200 were boilers and 600 were processes. Of this total, approximately 1/3 represent emissions sources under 25 tons per year. This sample of plants is much smaller than the population of industrial establishments in Ohio since over one-half of fuel burned is natural gas. Consequently relatively few plants are affected by sulfur oxide regulations.

2. Plants Included in this Analysis

Four categories of industrial establishments which were potential sources of sulfur dioxide emissions were identified: fuel combustion boilers, fuel combustion processes, chemical processes and fuel gas burning processes.

This categorization was developed due to similar costing procedures within each source type. Costing methods, however, substantially differed between the source categories.

Fuel combustion boilers include those sources which burn fossil fuel for the purpose of generating steam. Fuel combustion processes (general processes) burn fossil fuel in kilns and furnaces to provide process heat.

The chemical process category includes those sources which emit SO_x due to the chemical nature of the process, e.g., sulfuric acid plants and pulp mills.

Fuel gas burning processes are those which emit SO_x due to the combustion of gases containing hydrogen sulfide. Steel mills (using coke oven gas) and oil refineries (using refinery off-gas) dominated this category.

Three basic screening steps were utilized to refine the Ohio EPA data base. Plants were deleted at each step; the actual numbers are presented in Table III-1.

The initial screening deleted utility plants from the boiler category and incinerators from the general process category.

The second screening step deleted those plants within all categories for which negligible emissions were recorded by Ohio EPA. The majority of these are plants burning natural gas; although their annual SO_2 emissions may exceed the minimum of 10 tons SO_2 annually, their hourly emissions in pounds per million BTU's are considered insignificant. Oil fired boilers for which no emissions were recorded were also excluded in this step.

The final general screening step was a deletion of plants for which the data available was not sufficient to determine compliance. For general processes, this meant the lack of fuel use, emissions, or process weight rate data. For chemical processes, pulp mill process sources were excluded from the Ohio EPA inventory; six sulfuric acid plants were included on the data file, but 5 additional sulfuric acid plants are missing from the inventory.

The screening resulted in a data file of 302 /3 plants for which compliance analysis and costing could be completed.

3. Implications of Coverage of Costing

Due to the deletions of plants from the original data file explained above, it may be expected that costs

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3/ This total includes double counting of mixed plants (i.e., plants which have both boiler and process sources).

may be understated by at least five percent of capital costs and one percent of operating and maintenance costs reported by Battelle. This understatement of costs may be attributed to the omission of plants with insufficient data. The steam electric power plants omitted in this report are covered in a separate document on utilities.

SECTION IV

COSTS AND COMPLIANCE

A. Compliance

1. Proposed Regulations

Having completed the screening steps described in Section III the proposed regulations were applied to 302 plants and 128 were found to be out of compliance. Of the 128 non-complying plants, nearly two-thirds are located in the thirteen urban counties within Ohio; 62 or roughly half of the affected plants are located within four urban counties: Cuyahoga, Franklin, Stark and Summit. The remaining 45 out of compliance plants are spread throughout 75 rural counties.

Table IV-1 displays the distribution of non-complying plants by industrial categories. Five two-digit SIC's account for 64 (50%) of the 128 plants: paper, chemicals, petroleum and coal, rubber and plastics and primary metals. In over one-half of each of these industries, non-complying plants fall within a specific subindustry, i.e., steel mills (18 plants out of compliance); sulfuric acid plants (5 plants); oil refineries (5 plants); and fabricated rubber products (6 plants).

2. Final Regulations

Under the final regulations 113 plants are out of compliance. The drop in number between the proposed and final regulations reflects the relaxation or elimination of regulations in certain areas as discussed in Section II.

Table IV-2 shows the distribution by industry at the two and four digit SIC levels.

Urban counties account for 94 of the 113 out of compliance plants reflecting the greater stringency of final regulations in urban areas and the relaxation of sulfur limits in rural areas

TABLE IV-1

PROPOSED REGULATIONS

INDUSTRIAL COMPLIANCE STATUS

SIC	INDUSTRY	TOTAL PLANTS CONSIDERED	NUMBER OUT OF COMPLIANCE
20	Food Products	14	5
22	Textile Mill Products	2	1
25	Furniture and Fixtures	4	0
26	Paper	25	8
27	Printing and Publishing	1	0
28	Chemicals	27	15
29	Petroleum and Coal	12	6
30	Rubber and Plastics	15	9
32	Stone, Clay and Glass	27	6
33	Primary Metals	46	26
34	Fabricated Metals	13	6
35	Machinery, ex. Electrical	10	3
36	Electric, Electronic Equipment	8	5
37	Transportation Equipment	12	5
39	Miscellaneous Manufacturing	1	1
90	Non-Manufacturing Establishment	49	21
99	Miscellaneous Fuel Combustion	36	10
	TOTAL	302	128
3312	Steel Mills	31	18
2819	Sulfuric Acid Plants	6	5
2911	Petroleum Refineries	7	5
3274	Lime	1	1
3069	Fabricated Rubber	9	6
3341	Secondary Smelting	2	1
3241	Cement	6	4
3399	Primary Metals, NEC	3	3
3391	Miscellaneous Metals	2	2
	TOTAL	67	45

TABLE IV-2

FINAL REGULATIONS

INDUSTRIAL COMPLIANCE STATUS

SIC	INDUSTRY	TOTAL PLANTS CONSIDERED	NUMBER OUT OF COMPLIANCE
20	Food Products	14	4
22	Textile Mill Products	2	1
25	Furniture and Fixtures	4	0
26	Paper	25	9
27	Printing and Publishing	1	0
28	Chemicals	27	15
29	Petroleum and Coal	12	7
30	Rubber and Plastics	15	4
32	Stone, Clay and Glass	27	2
33	Primary Metals	46	20
34	Fabricated Metals	13	4
35	Machinery, ex. Electrical	10	2
36	Electric, Electronic Equipment	8	7
37	Transportation Equipment	12	4
39	Miscellaneous Manufacturing	1	1
90	Non-Manufacturing Establishment	49	19
99	Miscellaneous Fuel Combustion	36	12
	TOTAL	302	113
3312	Steel Mills	31	15
2819	Sulfuric Acid Plants	6	4
2911	Petroleum Refineries	7	4
3274	Lime	1	0
3069	Fabricated Rubber	9	2
3341	Secondary Smelting	2	0
3241	Cement	6	0
3399	Primary Metals, NEC	3	2
3391	Miscellaneous Metals	2	1
	TOTAL	67	28

in comparison to the proposed regulations. Half of the affected plants are located in four counties: Cuyahoga, Franklin, Lucas and Stark. In Stark County, however, the number of plants out of compliance falls by one-half reflecting the greater leniency in the county's regulations. Lucas County, on the other hand, more than doubled its number of plants out of compliance reflecting the tightening of that county's regulations in comparison with the proposed regulations. The remaining 19 plants out of compliance are distributed throughout the 75 rural counties.

The distribution of non-complying plants by industrial category remains roughly the same as under the proposed regulations. The most significant change is the absence of impact under the final regulations on general fuel burning process categories such as cement and lime kilns.

B. Costs

The following presentation of costs considers the results by industry and by type of installation (boiler vs. process). The latter is important since the regulation revisions tended to affect the type of unit out of compliance more than the industries affected. All costs shown are expressed in 1975 dollars.

1. Annual Costs

a. Proposed Regulation

Under the proposed regulation 128 plants were out-of-compliance but only 91 plants experienced annual control costs (annualized value of capital, operating and maintenance, and fuel costs) totaling 48.95 million. The remainder incurred no control costs because they are expected to comply with the regulations by using a slightly lower sulfur content coal with no cost increases. The industrial distribution of the annual cost in 1975 dollars is shown in Table IV-3. Two industries, chemicals and primary metals, account for nearly two-thirds of the annual costs incurred. Only two industries, printing and publishing and miscellaneous manufacturing, incurred no costs at all.

Controls on process installations account for a substantial share of annual costs for the industries with highest costs. For the primary metals industry, which incurred over one third of total annual costs, steel mill process unit controls were responsible for 84.6 percent of those costs. In the chemicals industry, process unit controls on sulfuric acid plants accounted for over one third of the total annual cost to that industry or $5.03 million. Controls on general processes and fuel burning processes were responsible for nearly all cost impacts on the stone, clay and glass and petroleum industries.

Non-manufacturing establishments (i.e., hospitals, educational institutions, government installations, etc.) were the only other group incurring over 5 percent of total annual cost. With $2.95 million of annual cost, these establishments constitute six percent of the total. All of the costs for non-manufacturing establishments reflect the compliance cost for boilers.

b. Final Regulations

Under the final regulation, 113 plants are out of compliance with only 66 incurring control costs. The annual cost to meet the final regulation is $41.16 million in 1975 dollars.

As shown in Table IV-4, primary metals and chemicals again account for almost two-thirds of the annual costs incurred. Three industries incur no costs under the final regulation: furniture and fixtures, printing and publishing and stone, clay and glass.

The changes in industry annual costs reflect tighter regulations for boilers and greater leniency in the regulation of processes. In the primary metals industry, which again constitute the largest portion of cost, boiler control costs have increased substantially and process costs have fallen. Stringent regulations on boilers in urban areas caused transportation equipment industry costs to increase nearly four-fold, while relaxed regulations on processes caused a slight drop in costs to the chemical industry and reduced stone, clay and glass costs to zero.

The change in the portion of the total annual cost incurred by each type of installation is summarized in Table IV-5.

TABLE IV-3

ANNUAL COSTS FOR OUT OF COMPLIANCE PLANTS, BY INDUSTRY

PROPOSED REGULATION

SIC	TOTAL NO. OF PLANTS	TOTAL NO. PLANTS OUT OF COMPLIANCE	$(10^{6}\$)^{1/}$ ANNUAL COST	% OF TOTAL	% OF COST FOR BOILERS	% OF COST FOR PROCESSES
20	14	5	0.60	1.21	100	0
22	2	1	0.09	0.18	100	0
25	4	0	0.00	0.00	0	0
26	25	8	1.14	2.33	100	0
27	1	0	0.00	0.00	0	0
28	27	15	13.86	28.31	63.7	36.3
29	12	6	3.85	7.87	3.4	96.6
30	15	9	1.09	2.23	100	0
32	27	6	3.63	7.42	2.2	97.8
33	46	26	16.90	34.53	16.86	83.14
34	13	6	0.23	0.47	100.0	0
35	10	3	0.62	1.27	100.0	0
36	8	5	0.29	0.59	100.0	0
37	12	5	.22	0.45	100.0	0
39	1	1	0.00	0.00	0	0
90	49	21	2.95	6.03	100.0	0
99	31	10	2.94	6.01	100.0	0
Other	5	1	0.54	1.10	100.0	0
TOTAL	302	128	48.95	100%		

TABLE IV-4

ANNUAL COSTS - OUT OF COMPLIANCE PLANTS

FINAL REGULATION

SIC	Total No. of Plants	Total No. Plants Out of Compliance	Annual Cost 10^6 \$[1/]	% of Total	% of Cost for Boilers	% of Cost for Processes
20	14	4	0.22	1.12	100	0
22	2	1	0.20	1.02	100	0
25	4	0	0.00	0.00	0	0
26	25	9	0.49	1.19	100	0
27	1	0	0.00	0.00	0	0
28	27	15	12.42	30.17	78.0	22.0
29	12	7	3.02	7.34	11.0	89.0
30	15	4	1.85	4.49	100.0	0
32	27	2	0.00	0.00	0	0
33	46	20	13.54	32.90	41.7	58.30
34	13	4	0.91	2.21	100	0
35	10	2	0.69	1.68	100	0
36	8	7	0.36	.87	100	0
37	12	4	1.36	3.30	100	0
38	0	0	0.00	0.00	0	0
90	49	19	1.40	3.40	100	0
99	31	12	4.14	10.06	100	0
Other	6	3	0.55	1.34	100	0
Total	302	113	41.16	100%		

[1/] 1975 \$

TABLE IV-5
ANNUAL COSTS OF PROPOSED AND FINAL REGULATIONS BY TYPE OF INSTALLATION

Type of Installation	Proposed		Final	
	Cost[1/] (Million $)	% of Total Annual Cost	Cost[1/] (Million $)	% of Total Annual Cost
Boilers	22.6	46.2	27.90	67.78
General Processes	3.61	7.37	.268	.65
Chemical Processes	5.03	10.28	2.67	6.49
Fuel Gas Burning Processes	17.71	36.18	10.32	25.07
Total	48.95	100.00	41.16	100.00

[1/] 1975 $

2. Capital Cost

a. Proposed Regulations

The capital cost incurred by 128 non-complying industrial plants was $66.60 million.

The distribution by industry is shown in Table IV-6. Primary metals incur two-thirds of capital cost and the chemical, petroleum and rubber industries constitute the other third. No capital cost is expected to be incurred by any other industry.

Process unit controls account for most of the capital expenditures required. Steel industry process units require almost all of the capital expenditures for the primary metals industry. In the chemicals and petroleum industry, all of the costs are for controls on sulfuric acid and refining process units, respectively. It is only in the rubber industry that boilers incur capital costs.

b. Final Regulation

The final regulations resulted in a capital cost of $51.88 million for 113 non-complying plants.

The industrial distribution of these capital costs is shown in Table IV-7. One industry, primary metals, accounts for half the total cost. Combined with the chemicals and petroleum industries, the three represent three-fourths of the cost incurred.

The greater stringency of the final regulations on boilers in urban areas and the leniency of regulations on process units account for the major changes in capital costs. The primary metals industry has a capital cost of $30.02 million. Process unit costs have decreased relative to the industry total, and boiler costs rose. The 27 percent decrease in capital costs for the petroleum refining industry and 46 percent decrease in chemical industry capital costs are also due entirely to relaxed process unit regulations.

TABLE IV-6
CAPITAL COSTS FOR OUT OF COMPLIANCE PLANTS
PROPOSED REGULATION

SIC	Total No. of Plants	Total No. Plants Out of Compliance	Capital Cost (10^6 \$) 1/	% of Total	% of Cost for Boilers	% of Cost for Processes
20	14	5	0.00	0.00	0	0
22	2	1	0.00	0.00	0	0
25	4	0	0.00	0.00	0	0
26	25	8	0.00	0.00	0	0
27	1	0	0.00	0.00	0	0
28	27	15	13.22	19.43	0	100
29	12	6	10.73	15.77	0	100
30	15	9	0.52	0.76	100	0
32	27	6	0.00	0.00	0	0
33	46	26	42.01	64.04	3.4	96.6
34	13	6	0.00	0.00	0	0
35	10	3	0.00	0.00	0	0
36	8	5	0.00	0.00	0	0
37	12	5	0.00	0.00	0	0
39	1	1	0.00	0.00	0	0
90	49	21	0.00	0.00	0	0
99	31	10	0.00	0.00	0	0
Other	5	1	0.00	0.00	0	0
Total	302	128	66.60	100%		

1/ 1975 \$

TABLE IV-7
CAPITAL COSTS FOR OUT OF COMPLIANCE PLANTS
FINAL REGULATION

SIC	Total No. Of Plants	Total No. Plants Out of Compliance	Capital Cost $(10^6\ \$)$ 1/	% of Total	% of Cost for Boilers	% of Cost for Processes
20	14	4	0.00	0.00	0	0
22	2	1	0.00	0.00	0	0
25	4	0	0.00	0.00	0	0
26	25	9	0.00	0.00	0	0
27	1	0	0.00	0.00	0	0
28	27	15	7.10	13.69	0	100
29	12	7	7.87	15.16	0	100
30	15	4	0.00	0.00	0	0
32	27	2	0.00	0.00	0	0
33	46	20	30.02	57.86	21.87	78.13
34	13	4	0.00	0.00	0	0
35	10	2	0.00	0.00	0	0
36	8	7	0.00	0.00	0	0
37	12	4	0.00	0.00	0	0
38	0	0	0.00	0.00	0	0
90	49	19	0.00	0.00	0	0
99	31	12	6.89	13.28	100	0
Other	6	3	0.00	0.00	0	0
Total	302	113	51.88	100%		

1/ 1975 $

TABLE IV-8

CAPITAL COSTS OF PROPOSED AND FINAL REGULATIONS BY TYPE OF INSTALLATION

Type of Installation	Proposed		Final	
	Cost[1] (Million $)	% of Total Capital Cost	Cost[1] (Million $)	% of Total Capital Cost
Boilers	.51	.77	13.44	25.96
General Processes	.12	.18	.467	.90
Chemical Processes	13.22	19.85	7.10	13.69
Fuel Gas Burning Processes	52.73	79.17	30.85	59.46
Total	66.60	100.00	51.88	100.00

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[1] 1975 $

The change in the share of capital costs incurred by each type of installation is summarized in Table IV-8.

C. Control Strategy Choices and Costs

The capital costs reflected in the preceding section result from the costs incurred by utilization of various control strategies available for pollution abatement described in the methodology section. (See Tables IV-9 and IV-10.)

1. Boilers

Under the proposed regulation, 35 percent of energy use by boilers must be controlled. However, less than one percent requires FGD (flue gas desulfurization) as a method of compliance, with an accompanying capital cost of $.7 million and an annual cost of $.26 million.

The remaining 37.7 percent are expected to switch from their current high sulfur fuel to lower sulfur coal, incurring no capital costs. An annual cost of $22.44 million results.

Under the final regulation 45 percent of total energy use requires control. FGD is not required by any boiler, reducing capital costs for boilers to zero. Low sulfur coal is required for 97.3 percent of non-complying boilers, at an annual cost of $27.1 million.

A small portion, .2 percent, of the energy used in boilers, is expected to switch from their current fuel, coal, to oil to meet the regulation. The cost of the switch is $.55 million in annual cost.

A switch to lower sulfur content oil also results from the final regulation; .4 percent of energy use in the form of high sulfur oil require the use of low sulfur oil to meet the regulation, incurring $.1 million of annual cost.

2. Fuel Combustion Processes

As stated in the methodology section, the range of control options for general processes is limited to low sulfur coal, except for smelters which are expected to use FGD.

Under the proposed regulation, four processes elected low sulfur coal, incurring an annual cost of $3.55 million and zero capital costs.

One secondary lead smelter, requiring FGD, incurred $1.12 million in capital costs and $.06 million in annual costs.

Under the final regulation, only one general process remained out of compliance, a lead smelter. FGD was the control option at a capital cost of $.467 million and an annual cost of $.268 million.

3. Chemical and Fuel Gas Burning Processes

Chemical processes are expected to select dual absorption or a similar technology as their method of control. The control strategies of chemical and fuel-gas burning processes are given in Table IV-11. The costs presented in Table IV-8 directly reflect the costs of these control strategies.

D. Comparison of the Costs of the Proposed & Final Regulations

As can be seen from the previous presentation of the costs of compliance, total costs, both annual and capital, differ significantly between the proposed and the final set of regulations.

Capital costs were $66.6 million for the proposed regulation and $51.9 million for the final regulation. Out of compliance plants incurred a total annual cost of $49.0 million under the proposed regulation and under the final regulation costs declined to $41.2 million.

The number of plants affected by the final regulation dropped to 113 from the 128 plants which had incurred costs under the proposed regulation. Moreover, the distribution of costs associated with each set of regulations differed considerably.

TABLE IV-9
CONTROL OPTIONS AND COSTS
SELECTED FOR OUT OF COMPLIANCE PLANTS
PROPOSED REGULATIONS

Proposed Regulation	Control Option	% of BTU's Out of Compliance	% Capital Cost	% Annual Cost
1. Fuel Combustion Boilers	FGD	0.5	100.0	4.4
	Low Sulfur Coal	99.5	0.0	95.6
	Coal to Oil	0.0	0.0	0.0
	Oil to Oil	0.0	0.0	0.0
		100.0	100.0	100.0
2. General Processes	FGD	0.4	100.0	1.7
	Low Sulfur Coal	99.6	0.0	98.3
	Coal to Oil	0.0	0.0	0.0
	Oil to Oil	0.0	0.0	0.0
		100.0	100.0	100.0

TABLE IV-10
CONTROL OPTIONS AND COSTS
SELECTED FOR OUT OF COMPLIANCE PLANTS
FINAL REGULATIONS

Final Regulation		Control Option	% of Total BTU's Out of Compliance	% Capital Cost	% Annual Cost
1.	Fuel Combustion	FGD	0.0	0.0	0.0
	Boilers	Low Sulfur Coal	98.6	0.0	97.3
		Coal to Oil	0.4	0.0	2.4
		Oil to Oil	1.0	0.0	0.3
			100.0	0.0	100.0
2.	General Processes	FGD	100.0	100.0	100.0
		Low Sulfur Coal	0.0	0.0	0.0
		Coal to Oil	0.0	0.0	0.0
		Oil to Oil	0.0	0.0	0.0
			100.0	100.0	100.0

* Includes Ohio Ed. (6.056×10^6 MMBTUs; 2.482×10^6 \$ Annual Cost)

TABLE IV-11
CONTROL OPTIONS AND COSTS SELECTED FOR OUT OF COMPLIANCE PLANTS PROPOSED AND FINAL REGULATIONS

	Control Option	$(10^{6}\ \$)$1/ Capital Cost	$(10^{6}\ \$)$ 1/ Annual Cost
A. Proposed Regulation			
3. Chemical Processes	Dual Absorption (6 plants)	13.22	5.03
4. Fuel Gas Burning Processes			
Steel Mills	AMINE SCRUBBER/STRIPPER plus CLAUS (11 plants)	42.00	14.05
Oil Refineries	AMINE SCRUBBER/STRIPPER plus CLAUS (3 plants)	8.26	2.89
	ADDITIONAL TAIL-GAS (2 plants)	2,47	0.83
B. Final Regulation			
3. Chemical Processes	Dual Absorption (4 plants)	7.10	2.67
4. Fuel Gas Burning Processes			
Steel Mills	AMINE SCRUBBER/STRIPPER plus CLAUS (6 plants)	22.98	7.62
Oil Refineries	AMINE SCRUBBER/STRIPPER plus CLAUS (3 plants)	6.45	2.23
	ADDITIONAL TAIL-GAS (1 plant)	1.42	0.47

1/ 1975 $

Under the proposed regulation, of the 128 non-complying plants, 65% were urban plants and 35% were rural plants. The mix was quite different for the final regulation, where of 113 non-complying plants, 83 percent were urban and 17 percent were rural. The actual number of rural plants out of compliance decreased from 45 to 19, while urban plants increased from 83 to 94. These trends reflect the greater stringency of the final regulations in urban counties.

Based on the change in the distribution of costs between the two regulations, fuel combustion boilers are regulated more heavily under the final regulations and, overall, processes were regulated less stringently.

As can be seen in Table IV-7, costs for boilers increased as a percentage of total under the final regulation. While boilers incurred no capital costs, annual costs for boilers increased from 46.3 percent of total to 56.3 percent of the total for the final regulation.

Capital costs under the final regulation represent solely process costs. It should be noted that process capital costs declined from $66.1 million to $51.9, reflecting the lesser stringency of process regulations in the final package.

With respect to the distribution of impact among industrial groups, costs remained fairly stable between the regulations. Two industries, chemical and primary metals still incur the greatest percent of cost, both capital and annual. Other industrial groups, such as clay, stone and glass, which incurred costs under the proposed regulations were unaffected by the final regulations.

Therefore, due to the shifting structure of the regulations, the distribution of cost impacts shifted from process to boilers and from rural to urban but cost burdens remained concentrated in the same industrial sectors.

E. Costs of Growth Projected to 1985

The additional costs associated with growth projected to 1985 for all plants which experienced capital or annual costs under the final regulation are summarized in Table IV-12.[1] The increases in annual and capital cost reflect only the additional costs incurred by existing plants using 1973-1975 data. Compound annual average growth factors were applied for ten years to calculate projected growth and costs for those plants.

It should be noted that these figures overstate the total costs since they imply all plants are subject to the final regulations. Some new plants would be subject to federal New Source Performance Standards and are thus not impacted by these Ohio regulations.

TABLE IV-12

	1975 (10^6 \$)[2]	1985 (10^6 \$)[2]	Increased Cost (10^6 \$)[2]	% Increase
Total Annual Cost	41.2	47.4	6.2	15.0
Total Capital Cost	51.9	60.0	9.1	17.5

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[1] Growth factors provided by Region V. Urban source growth was projected for each county by SIC code. Rural source growth was projected through the use of a county-wide factor.

[2] 1975 $

SECTION V

ECONOMIC IMPACT

A. Introduction

The purpose of this section is to outline the steps taken in evaluating the economic impacts of two alternative SO_2 emission standards proposed by EPA for the state of Ohio. It was decided to perform the analysis at the plant level in order to highlight the industrial impacts. This was deemed necessary because the average effect of the standards on any industry is expected to be negligible. This tendency to obscure impacts by averaging can be illustrated as follows. If there are 100 plants in an industry, 50 of which are out of compliance, and only 10 which incur significant price increases, then the average impact for the industry is weighted by the 90 plants with no or low impacts. The resulting weighted average would show a price effect of less than 1 percent leading to a potentially misleading conclusion of no significant impacts. The analysis focuses on the distribution of the impacts among affected plants to identify the plants with significant impacts.

Because of the large number of plants being evaluated, a thorough economic analysis cannot be conducted for each plant. Therefore, it is critical that an initial screening step be undertaken to identify those plants which might experience significant impacts. The approach taken here is to select evaluation criteria which tend to possibly overstate the impacts, but will insure that no impacted plants will be overlooked. This is done in a series of screening steps, each at a greater degree of refinement to generate more accurate estimates of effects.

A more thorough economic analysis is then conducted on those plants or industry groups which appear to experience significant impacts. This includes an examination of the price, employment, output, and financial impacts. Due to time constraints, the analysis of employment and output impacts was conducted only on the industries affected under the final regulation.

This section is divided into three major subsections. The first describes the methodology and the estimated price impacts. The second subsection analyzes the financial impact methodology and conclusions.

The last section contains the follow-up economic analyses performed on those sectors expected to incur significant price or financial impacts.

The details of the screening steps taken to determine which plants and industries may experience impacts and the intermediate results of these steps are included in Appendix D. The data sources for this screening analysis are found in Appendix E.

B. Price, Employment, and Output Impacts

1. Overview of Methodology

a. Screening Methodology

In order to select those plants and industries which will suffer possible severe economic impacts due to the regulations, it is necessary to obtain a measure of the magnitude of the effect of the annualized control costs for each of the plants. To perform the first step of this screening process, it was assumed that the plants will pass on all of the annualized control costs as price increases. Clearly, the best method for assessing the magnitude of these price increases is by comparing the estimated annualized control costs to such plant-specific economic data as total sales.1/ Such an approach would allow a direct comparison at the plant level.

1/ Total sales may be inappropriate if the controls only affect one of many products at the plant. The resulting impacts could be understated, but product sales were not available within the time constraints of this study. The exception is that for the sulfuric acid industry; value of production was used.

There are many factors which will determine how control costs actually affect the plant. For example, if the above process leads to the determination of a substantial price increase, the plant may decide not to pass on all the costs in order to retain its competitiveness in the market. The plant may absorb the costs and reduce profits, depending on the status of the product being produced. Alternatively, a price increase may result in a drop in demand for the output of the plant with associated declines in production and employment.

b. Implementation of the Screening Methodology

As just described, the analysis is based on a plant-level comparison of the control costs and the value of sales. Initially, EEA attempted to develop plant-specific data by asking the Marketing Services Division of Dun and Bradstreet, Inc. to provide sales data for each manufacturing plant in the inventory. The advantage to using this data was that the sales figures were the value of shipments at the plant and not the value of sales of the final product, an important distinction for plants that produce intermediate goods. This search was not successful because the only sales data available were at the corporate level. While some plant level data appeared to be available, it could not be prepared within the time frame of this study.

Due to the lack of plant-specific data for manufacturing plants, it is necessary to approximate by using aggregate industry data. For example, when plant-specific energy consumption data is available, this figure is used to estimate plant-level sales by assuming that the ratio between sales and energy consumption is the same at both the plant and aggregate industry levels. The following equation is used to calculated plant level sales:

$$\text{Plant Sales} = \frac{\text{Industry-wide Sales}}{\text{Industry Energy Consumption}} \quad \text{X Plant Energy Consumption}$$

That is, a series of sales to energy ratios are developed for each industry and these are multiplied by the energy consumption levels of the individual plants within those industries. These calculated annual sales figures can then be compared to the annualized control costs as described in the preceding section.

For the non-manufacturing establishments, such as hospitals and schools, plant-specific budget data was obtained with which to compare the control costs. The impacts on the operating budgets[1/] of these institutions was then evaluated.

The validity of the above procedure for developing plant-level data for manufacturing establishments hinges on the assumption that each plant within an industry is a mirror image of that industry. That is, by assuming a constant sales to energy ratio, we are tacitly implying that each plant's energy consumption pattern is the same as that of the aggregate industry; and that total sales for the industry corresponds to the value of shipments for the plant.

Clearly this assumption is only a crude approximation. For example, in the steel industry more energy is used per unit of output to produce pig iron than to produce finished steel. Thus, using the average energy sales ratio for the steel industry tends to understate the estimated sales level at a plant which does not include smelting, primary and secondary finishing operations. Also, the total final sales figure used for the steel industry will tend to overstate the estimated plant sales when the value of a unit of intermediate product (e.g., pig iron) is less than that of the final product.

Given the deficiencies of aggregate energy/sales ratios at the 2 or 4 digit SIC level, the approach adopted was to estimate this ratio in successive levels of sophistication. The first screening parameters were designed specifically to

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[1/] This includes payroll, fixed cost (e.g., utilities, communications), equipment rental, maintenance and repair, contractual services, and supplies.

overstate price impacts to insure that potential impacts would not be overlooked. For example, the first screening energy/sales ratio for boilers implicitly assumed that all fuel used in the plant was coal and all fuel was out of compliance. Since most plants also use other fuels and some stacks may be in compliance, this tends to overstate price impacts. At later stages of the screening prices, results were evaluated to determine whether such biases appeared to be an important factor.

Later screening steps included:

- verifying the fuel consumption pattern and fuel quality,
- accounting for actual fuel use affected by the regulations rather than total energy use within the industrial classification,
- refining sales data to account for state specific factors.

These refinements of the first step in the screening process frequently led to much lower estimates of price impact than were first determined. The details of these successive screening steps can be found in Appendix D.

The final results of the price impact analysis, determined after the last step of the screening process, are summarized in part 2 of this section.

It should be emphasized that the results of this analysis cannot be viewed as accurate estimates for individual plants but rather should be considered indicative of the magnitude of impacts and numbers of plants affected.

c. Outline of the Follow-Up Analysis on Price Impacts

Once these more sophisticated screening steps had identified plants or industry groups impacted (defined as price impacts greater than 1 percent), then a follow-up economic analysis was performed.

A crucial factor, as suggested above, is the threat of competition. If the plant's competitors are affected less by the regulations, or are not regulated, it will be difficult for the plant to raise the price of its product and retain its share of the market.

Other factors include the price elasticity of demand of the product, which may indicate a steep decrease in demand if the price increase is sufficiently high. If the market for the product is static or declining, it may be difficult to raise the price of a product. Also, government regulations may not permit a price rise in a particular industry. If the plant services a local market, even a significant price increase may not jeopardize its ability to compete. The nature of the analysis conducted was dependent on the industry(s) impacted.

2. Price Impact Results

This section presents the results of the price impact screening methodology.

a. County Price Impacts

The proposed regulation resulted in cost increases in 30 of the 88 counties in the state. The number of affected counties dropped to 21 for the final regulation, a result of the general relaxation of the regulations.

b. Price Impacts by Industry

(1) Industries not impacted

A few industries that were covered by the regulations were not impacted. For both regulations, those included the furniture and fixtures industry, and printing and publishing. The proposed regulation did not affect plants categorized as general manufacturing, and the final regulation left the stone, clay and glass products industry unaffected.

(2) Magnitude of impacts

(a) Proposed regulations

Ninety-one of the 128 (71 percent) plants that were out of compliance with the proposed regulation are estimated to incur cost impacts.[1/] Of these, 20 are expected to experience price impacts greater than 1 percent. Among these are 8 non-manufacturing institutions, and 12 plants in three industries. The ranges of their price impacts are listed below:

Industry	Percent Increase
Sulfuric Acid	5-23
Cement	1-5
Rubber Products	1-10
Institutions	1-12

(b) Final Regulation

Under the final regulation, 66 plants out of the 113 (58 percent) that were out of compliance are estimated to incur cost impacts. It was determined that only 7 plants would expect price impacts greater than 1 percent. These include 4 sulfuric acid plants and 3 institutions (2 plants at an air force base and a medical center). The percentage price increases for the sulfuric acid plants are estimated to range from 1 to 21 percent. Those for the institutions range from 1 to greater than 100 percent. It was determined that the sulfuric acid industry warrants a follow-up economic analysis, found in section D.

Although it may be hypothesized that the cement and rubber plants affected under the proposed regulation might incur serious economic impacts, the follow-up analysis focused on only the effects of the final regulations on the sulfuric acid industry.

[1/] The remaining 37 plants should be able to obtain a slightly lower sulfur content fuel at about the same cost they currently pay.

C. Financial Impacts

1. Introduction

Financial impacts are of concern in this study in two respects. First, a conventional evaluation focuses on whether the affected companies will be able to finance the required pollution control investments without foregoing other planned investments, incurring a significant deterioration in financial health (measured by such parameters as debt-equity or interest coverage ratios) or damaging their credit ratings. Second, a company may elect to shut down a plant rather than incur the capital costs, particularly if it was scheduled to be phased out in the near future. 1/

Initially, the impacts were evaluated at the plant level to screen out those plants which would not require significant (greater than 5%) increases in their capital budgets (these steps are described in Appendix D). However, the number of plants incurring any capital costs was so small that all impacted plants were included in the examination of the effects of those costs on the corporate level.

2. Financial Impact Results

a. Financial Impact of Proposed Regulations

Only four industries are estimated to incur capital costs under the proposed regulations: steel, chemicals, petroleum refining and rubber. Sixteen firms, representing twenty-three plants within these industries were affected. In order to

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1/ This second concern is particularly important in this study since remaining plant life could not be taken account of in the price impact analysis which assumes the average life is the same for all plants. Thus by focusing on the age of plants with significant capital costs we may pick up impacted or shut down cases which were not highlighted in the price effects discussion.

approximate corporate behavior, it is assumed that investments are financed over a period of three years. The capital expenditures required for compliance exceeded 1 percent of average annual corporate capital expenditures for only nine firms, [1] representing fourteen plants. Capital costs as a share of average annual corporate capital expenditures ranged from 1.0% to 6.2%. [2]

b. Financial Impact of Final Regulations

Three industries are estimated to incur capital costs under the final regulations: steel, chemicals, and petroleum refining. Nine firms, representing thirteen plants within these industries were affected.

The capital expenditures required for compliance exceeded 1% of average annual corporate capital expenditures for only three firms, [3] representing four plants. The share of average annual corporate capital expenditures represented by the capital costs of compliance incurred by these firms was less than 2% for both firms for which financial information was available.

1/ Financial information was unavailable for one of these firms but the significance of the share of average capital expenditures was estimated based on information about costs and production.

2/ Percentages are for those eight firms for which financial information was available.

3/ Financial information was unavailable for one of these firms but the significance of the share of average capital expenditures was estimated based on information about costs and production.

Capital Impact of Proposed and Final Regulations

	Proposed Regulation	Final Regulation
# of plants incurring capital costs	23	13
# of plants incurring significant costs	14	4
# of firms incurring capital costs	16	9
# of firms incurring significant costs 1/	9 2/	3

c. Plant-specific Financing Considerations

Investigation of the possible significance of plant age on the corporate investment decision revealed that one of the oil refineries which is estimated to incur capital costs is very old. The need for capital investment at that facility might precipitate a decision to close that plant. 3/

D. Follow up Analysis of Economic Impacts

1. Introduction

The economic impact of the final regulations will be confined to the steel and sulfuric acid industries. Some companies in the steel industry may experience significant capital impacts while some companies in the sulfuric acid industry may experience both significant price and capital

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1/ Costs are considered significant if they exceed 1% of average annual corporate capital expenditures.

2/ Financial information was unavailable for one firm--impact on corporate level is estimated.

3/ Information regarding age of plant is from conversation with member of staff of local air pollution control center.

impacts. These impacts are not expected to be severe in either industry.

2. Steel Industry

Six steel plants appeared to incur capital costs under the final regulations. These six plants are owned by four companies. However, when the increase in capital expenditures was examined at the corporate level, the analysis indicated that only two companies (including three plants) would be required to increase annual capital expenditures by more than 1 percent. To evaluate the impact of the final regulations on these two companies, industry, company and plant specific factors were considered.

a. Industry Factors

Prospects for growth and profitability in the steel industry have improved since the early 1970's when depressed profit margins and a rising volume of impacts threatened the viability of certain sectors of the industry. In that atmosphere, expenditures for pollution controls were viewed by industry as particularly onerous. In 1973 volume improved and by 1974 industry profitability soared. While earnings for 1975-1977 will remain below 1974 levels, they are considerably above the pre-1974 rate. Because capital expenditures were reduced during the period of depressed earnings and capacity expansion were delayed, the industry is now in a catch-up phase. Capital expenditures for pollution controls must compete with the other more productive investment demands. The ability of the industry to raise or internally generate the necessary capital will be a function of future earnings prospects. In general, the fortunes of steel are tied to those of the general economy. Increased manufacturing activity and higher demand for consumer durables and capital goods will improve the profitability of steel companies. An economic downturn on the other hand could reduce capacity utilization and cause severe profit declines because of the high fixed costs involved in the steel manufacturing process.

b. Company Factors

In Ohio, ten steel industry coke oven plants operated by six steel companies were identified. Three plants operated by two of the steel companies were found to incur capital costs of $9.5 million to comply with the final regulations.

Both of the steel companies affected are among the top ten steel producers in the nation. Together, their capital expenditures in 1975 exceeded $340 million. Projections through 1977 show that the companies will more than double their capital expenditure rates of 1974. These investments will be financed by a combination of long term debt and internally generated funds that will allow the companies to maintain historical debt equity ratios. Both have interest coverage ratios greater than 2.5 and are expected to maintain adequate coverage ratios.

Because capital expenditures are projected to increase rapidly, the impact of the proposed controls on a percentage of 1977 capital expenditures will be quite low. Assuming that the expenditures are spread over three years, in neither case will they amount to greater than 1 percent of projected 1977 capital expenditures. These investments would not significantly affect the company's capital structures. Even if all the funds were borrowed, they would amount to less than .5 percent of outstanding (on balance sheet) long term debt.

C. Plant Specific Factors

The decision to invest additional capital in pollution control equipment, however, will depend on plant specific factors including profitability, age, replacement value and other pollution control expenditures required. One of the plants is in the Mahoning River Valley and since 1970 the company has invested over $50 million in the facility.[1/] The additional requirements for air and water pollution controls, however, could be over $100 million. The willingness of the company to make the requisite expenditures will depend upon its estimate of the future competitiveness of the plant.

Because closure of the steel plants in the Mahoning River Valley could drastically affect the economic welfare of the area, the Environmental Protection Agency has already undertaken special studies of the problem. Based on these an exemption from the 1977 Clean Water Act Amendment requirements for installation of best practicable control technology was granted. Air standards, however, will be enforced and the plants must bear this cost of compliance. The cost of complying with the SO_x standards are expected to be far below the costs which would have been incurred in complying with the water pollution control requirments.

The other steel company with two impacted plants has a strong capital structure. In addition the impacted plants are relatively new and there are no obvious obstacles to preclude the necessary investment.

[1/] Booz-Allen and Hamilton, Economic Impact of Pollution Control Regulations on Steel Plants in the Mahoning River Valley, USEPA, 1976.

3. Sulfuric Acid

(a) Summary of File and Capital Impacts of the Final Regulations

The capital cost of installing abatement equipment to comply with the final regulations exceeded $7 million. If 100% of the annual control costs were converted to price increases, the price impact for the affected plant would range from 3-20%. The potential impact of these costs on output, employment and financial liability are discussed in this section.

(b) Description of Industry

Sulfuric acid is one of the largest volume industrial chemicals produced in the United States. The United States is the world's leading producer of sulfuric acid, producing 32.4 million short tons (1975) and having a production capacity of over 41.0 million short tons.

There are 251 sulfuric acid plants in the United States. A sulfuric acid plant is an establishment which, by use of either elemental sulfur, spent acid or hydrogen sulfide input, produces varying concentrations of sulfuric acid (H_2SO_4).

The primary use of sulfuric acid is in the production of fertilizers. Oil refineries and chemical producers are the next largest consumers. Other markets for sulfuric acid include the synthetic fiber and steel industries. 1/

Small companies involved solely in the production of sulfuric acid are rare. Almost all plants are owned by large diversified corporations. An inventory compiled by USEPA Durham

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1/ Research Triangle Institute, Comprehensive Study of Specified Air Pollution Sources to Assess the Economic Impact of Air Quality Standards FR-410-649 Vol. 1.

shows 11 sulfuric acid plants within Ohio.[2/] In only one of these cases is sulfuric acid the only product of the company. The other plants are owned by diversified, integrated corporations.

Two types of plants are of concern within Ohio: sulfur and sludge burning sulfuric acid plants. A sulfur burning plant is one which produces sulfuric acid from elemental sulfur input. A sludge plant produces sulfuric acid by reprocessing industrial byproduct (generally hydrogen sulfide) and reclaiming the spent acid contained in that byproduct. Only one Ohio sulfuric acid plant is a sludge processor.

(c) Nature of the Market

Sulfuric acid, because of its use as an industrial input, is considered an intermediate good. As an intermediate product, competition within its markets might be expected to be greater than competition for final products (e.g., food processing) which serve local markets. However, the market for sulfuric acid appears to be confined to consumers within the immediate locality of the plant or at least within state boundaries.

(1) Plant Type

Plants producing sulfuric acid are categorized as either captive or merchant, depending on the market the seller faces.

A captive plant is one whose consumers are solely dependent on the plant's product as a source of sulfuric acid. Captive plants therefore have more market security based on the complete dependency of their consumers. The dependency is partially explained by geographic proximity (discussed below under trans-

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[2/] Research Triangle Institute. Data available in this study covered only 6 Ohio sulfuric acid plants. For the remaining plants, missing data precluded evaluations of compliance status and control costs.

portation costs) and partially by the relationship developed between certain industries and sludge plants.

Merchant plants sell their product entirely on the open market, competing with each other for those consumers not tied to captive plants. Typically, the market is less secure for merchant plants.

Within the United States, only 40% of sulfuric acid production is merchant while 60% is captive. The majority of plants producing sulfuric acid therefore have certain markets who are wholly dependent consumers.

This national context is not representative of the Ohio market. From what could be determined within the time constraints of this study, only one of the Ohio sulfuric acid plants is captive, and is so for only one-third of its product. Therefore, the Ohio percentages differ markedly from the national, with 94% of Ohio acid production covered in this study classified as merchant, and the remaining 6% representing captive production.

Sludge plants are in a unique position due to the nature of their raw material input. Sludge plants are generally in a captive position as they must develop relationships with various industries in order to continue the source of raw material supply; i.e., industries find it economic to sell their byproduct to sludge plants and then buy back the reprocessed acid. In fact, the only sludge plant within Ohio is also the only captive plant in Ohio.

Nevertheless, it does appear that the Ohio sulfuric acid industry services local markets, and is insulated from competition outside the state. Transportation costs are mainly responsible for this market situation.

(2) Transportation Costs

An important factor which tends to produce a more secure market for sulfuric acid producers in Ohio is the cost of transporting sulfuric acid over any distance.

Most sulfuric acid is consumed near its point of manufacture, by either the producer or by nearby industries. Very little is shipped more than 150 miles. 1/

The price of sulfuric acid (1975) averaged $33.0 f.o.b. nationwide per ton on the commercial market, with spot market prices going as high as $41.0 per ton and long-term contract discounts down to $23.0 per ton. 2/

Transportation costs constitute a very large percentage of the average price of $33.0 per ton; rail costs range between 22-80% of the price of sulfuric acid (see Table V-1). The table shows that the cost of transportation within Ohio, by rail, while lower than out-of-state costs, is still high.

As far as could be determined within the time available for this analysis, rail is the major method of transportation for sulfuric acid movement in Ohio. While barge rates tend to be lower, averaging $.01/ton mile compared with the rail average of $.13/ton mile, it appears that barges are used infrequently a method of transportation within Ohio.

A final method of transportation, tank vessels for movement on the Great Lakes does not appear to be a major factor in the market.

1/ Research Triangle Institute, Comprehensive Study of Specified Air Pollution Sources.

2/ Chemical Marketing Reporter, August 30, 1976.

TABLE V-1

Overland Rail Transportation Costs

Destination(a	Method	Minimum Load	Price Per Ton ($)
Detroit to Toledo	Bulk Tank Car	r35	7.18
Detroit to Cleveland	"	26,000 lbs.	19.81
		40,000 lbs.	15.61
		140,000 lbs.	10.99
Cleveland to Toledo	"	26,000 lbs.	12.82
		40,000 lbs.	11.05
		140,000 lbs.	7.30
Akron to Toledo	"	26,000 lbs.	15.43
		40,000 lbs.	11.76
		140,000 lbs.	8.51
Nitro(WV) to Cleveland	"	26,000 lbs.	26.78
		40,000 lbs.	24.66
		140,000 lbs.	18.00
Hammond(IN) to Toledo	"	r35	24.70
		90,000 lbs.	21.57
		140,000 lbs.	15.74

(a these cities were selected because the point of departure has a known large sulfuric acid plant and the point of destination has known sulfuric acid consumers. The non-Ohio cities are the next nearest locations of sulfuric acid production.

In comparison to rail transport costs from neighboring states to Ohio of from $7-26 per ton of sulfuric acid, pollution control costs for Ohio plants could raise product prices by $1-7 per ton. Assuming that the sulfuric acid market within Ohio is competitive and that the costs of producing sulfuric acid are similar among states in this region, it would appear that these potential price increases for Ohio plants are overshadowed by the high transport costs. Thus, it appears unlikely that the Ohio plants would suffer any significant losses of local market due to imports of sulfuric acid from neighboring states.

Ohio sulfuric acid producers do have one area of possible competition, however. Imports from Canada, entering the United States duty-free, have a custom value (i.e., excluding freight, and insurance and reflecting the value at port of entry) of $15.5 per ton. While Canadian imports may pose a competitive threat, it should be noted that the transportation costs to Ohio would reduce that price advantage somewhat.

(3) Regulatory Requirements in Neighboring States

Any competitive advantages that nearby-state sulfuric acid plants might have in light of Ohio's regulations is further diminished since all neighboring states also have emission regulations within the same range as the Ohio regulations.

Ohio sulfuric acid plants must comply with regulations ranging from 4.8-21 pounds SO_2 per ton of acid produced; the regulations in the surrounding states allow emission levels ranging from 6.5-30 pounds SO_2 per ton of acid produced.

Some of the Ohio plants do appear to be subject to slightly more stringent emission limitations. However, the marginal costs per pound of sulfur dioxide removed for this industry do not rise sharply at more stringent limits, but tend to remain constant over the above range of regulatory requirements. Control costs are estimated to increase product prices by $.30 for a change of 1 pound of SO_2 in emission limits. Consequently for many plants in neighboring states, the improvement in their competitive position vis-a-vis Ohio plants would be substantially less than the $1-7 per ton of product noted above.

(4) Producer Competition

Other factors which limit competition for the sulfuric acid industry are the obstacles confronting consumers should they opt to produce their own sulfuric acid as a means of avoiding either higher acid prices or transportation costs.

As stated, many industries have byproducts that can be transformed into sulfuric acid. Not all industries have this byproduct reprocessed; some deal with sludge plants, but the remainder buy pure sulfuric acid. Such industries, however, could conceivably build their own sludge plants to reprocess their byproducts and thus become their own source of supply.1/

In actuality, few industries select this alternative because of the high capital expense associated with such plants. In addition, New Source Performance Standards which limit sulfur dioxide emission from new sulfuric acid plants are more stringent than the final EPA regulations. Thus, the combination of large capital investments and the additional cost of pollution abatement equipment for new plants should allow existing plants to maintain their competitive position.

1/ Effluent guidelines for other industries (e.g., steel) may increase the likelihood of sulfur processing facilities being built as a control strategy for those industries. This may act to reduce demand for existing sulfuric acid plant product.

(d) Summary

It appears unlikely that the sulfuric acid industry in Ohio will be seriously impacted by the final EPA regulations.

The Ohio sulfuric acid plants employ approximately 417 workers[1/] among four plants, averaging 104 workers per plant. Ohio represents approximately 9 percent of the national total of sulfuric acid industry employees. In total numbers, any employment impact would affect only a small number of employees, and less than 1 percent of all manufacturing employees in the state.

Transportation costs for sulfuric acid are very high in relation to product prices. Thus, it will be difficult for plants in other states to take advantage of the slightly more stringent regulations applicable in Ohio. The only competitive threat might be Canadian imports.

Although capital requirements are estimated to be substantial for all of the sulfuric acid plants needing control, the structure of the industry assures that capital costs will have a relatively small impact. Under the proposed regulations 4 companies (owning five plants) incurred capital costs. Under the final regulations, three of the same companies (owning four plants) incurred capital costs. In each case, all but one company were large, diversified corporations for which the capital costs of pollution are less than 1% of total corporate control expenditures. For one firm, a single plant corporation, incremental capital costs of compliance probably constiture a significant percentage increase in investment expenditures.[2/]

[1/] Marketing Services Division of Dun and Bradstreet, Inc.

[2/] Corporate financial records for this firm could not be obtained in the time available for this study.

However, this firm has a partially captive market and is already nearing completion of plans to install control equipment that would meet the final USEPA regulations.

It appears that no significant impact on investment demand will be felt by sulfuric acid producers as a result of the EPA air quality regulations.

Finally, the most significant factor is that the sulfuric acid plants already appear to have undertaken the necessary compliance steps and have done so in response not to the USEPA regulations, but to the existing state regulation. Therefore, no significant additional impacts of the USEPA regulations on the sulfuric acid industry are expected.

Apparently only one sulfuric acid plant has delayed installation of control systems; the plant has threatened shutdown as of September 1, 1976 unless litigation by the state, based on the plant's violation of the state regulation, is dropped. If that plant does shut down, its markets could presumably be captured by other Ohio plants, further reducing the likelihood of any adverse impacts on the other sulfuric acid producers in Ohio.

E. Impact of Projected Costs

The impact of costs associated with the growth projections to 1985 (discussed in the previous section) is not expected to change substantially from the current impacts. Increased costs due to rising production are assumed to be matched by a proportional increase in sales. Therefore, the ratio of cost to sales is expected to remain roughly constant, i.e., the magnitude of impacts will not change.

However, to the extent that industrial growth is uneven, i.e., some industries will expand at a more rapid rate than others, the distribution of the costs and impacts may change.

APPENDIX A

1. PROPOSED REGULATIONS
2. FINAL REGULATIONS

Appendix A-1

PROPOSED REGULATIONS

BOILERS

			Lbs $SO_2/10^6$ Btu/Hour		
			10^6 Btu/Hour		
County	Ohio I.D.	All Sizes	<22.5	22.5-3000	>3000
Adams	07-01	2.0			
Allen	03-02	1.6			
Ashland	02-03	N			
Ashtabula	02-04	1.2			
Athens	06-05	3.2			
Auglaize	03-06	4.8			
Belmont	17-07		6.0	(b)	1.2
Brown	01-08	N			
Butler	18-09		2.4(c)	(d)	1.2(c)
Carroll	02-10	N			
Champaign	05-11	N			
Clark	08-12	5.2			
Clermont	18-13	0.6			
Clinton	05-14	N			
Columbiana	17-15	4.4			
Coshocton	02-16	4.0			
Crawford	03-17	6.8			
Cuyahoga	13-18		6.0	(b)	1.2
Darke	08-19	N			
Defiance	03-20	N			
Delaware	03-21	6.0			
Erie	03-22	4.0			
Fairfield	01-23	5.6			
Fayette	01-24	N			
Franklin	01-25	2.4			
Fulton	03-26	N			
Gallia	06-27	4.4			
Geauga	02-28	N			
Greene	08-29	1.2			
Guernsey	01-30	N			
Hamilton	14-31		2.4(c)	(d)	1.2(c)
Hancock	03-32	3.2			
Hardin	03-33	N			
Harrison	02-34	N			
Henry	03-35	3.6			
Highland	01-36	N			
Hocking	01-37	5.6			
Holmes	02-38	N			
Huron	03-39	4.8			
Jackson	06-40	N			
Jefferson	17-41		6.0	(b)	1.2
Knox	03-42	4.0			

Appendix A-1 (cont'd)

County	Ohio I.D.	All Sizes	Lbs $SO_2/10^6$ Btu/Hour		
			10^6 Btu/Hour		
			<22.5	22.5-3000	>3000
Lake	02-43		6.0	(b)	1.2
Lawrence	07-44	4.4			
Licking	01-45	3.2			
Logan	05-46	N			
Lorain	19-47		6.0	(b)	1.2
Lucas	04-48		6.0	(b)	1.2
Madison	01-49	N			
Mahoning	02-50		6.0	(b)	1.2
Marion	03-51	4.0			
Medina	16-52	N			
Meigs	06-53	N(a)			
Mercer	03-54	5.6			
Miami	08-55	2.8			
Monroe	17-56	N			
Montgomery	08-57		3.0(c)	(e)	1.6(c)
Morgan	01-58	2.4			
Morrow	03-59	N			
Muskingum	01-60	0.6			
Noble	01-61	N			
Ottawa	03-62	1.6			
Paulding	03-63	N			
Perry	01-64	N			
Pickaway	01-65	6.0			
Pike	01-66	5.2			
Portage	16-67	5.6			
Preble	08-68	N			
Putnam	03-69	N			
Richland	03-70	1.2			
Ross	01-71	5.2			
Sandusky	03-72	N(a)			
Scioto	07-73	4.0			
Seneca	03-74	3.2			
Shelby	05-75	N			
Stark	15-76	1.6			
Summit	16-77		6.0	(b)	1.2
Truball	02-78		6.0	(b)	1.2
Tuscarawas	02-79	3.2			
Union	03-80	N			
Van Wert	03-81	N			

Appendix A-1 (cont'd)

County	Ohio I.D.	All Sizes	LBs $SO_2/10^6$ Btu/Hour 10^6 Btu/Hour <22.5	22.5-3000	>3000
Vinton	06-82	3.6			
Warren	18-83	N			
Washington	06-84	2.4			
Wayne	02-85	2.8			
Williams	03-86	N			
Wood	03-87	1.6			
Wyandot	03-88	N			

Notes:

N = No limits set

(a) Counties omitted from listing in 40 FR 52410; the Technical Support Document indicates these are no-limit counties

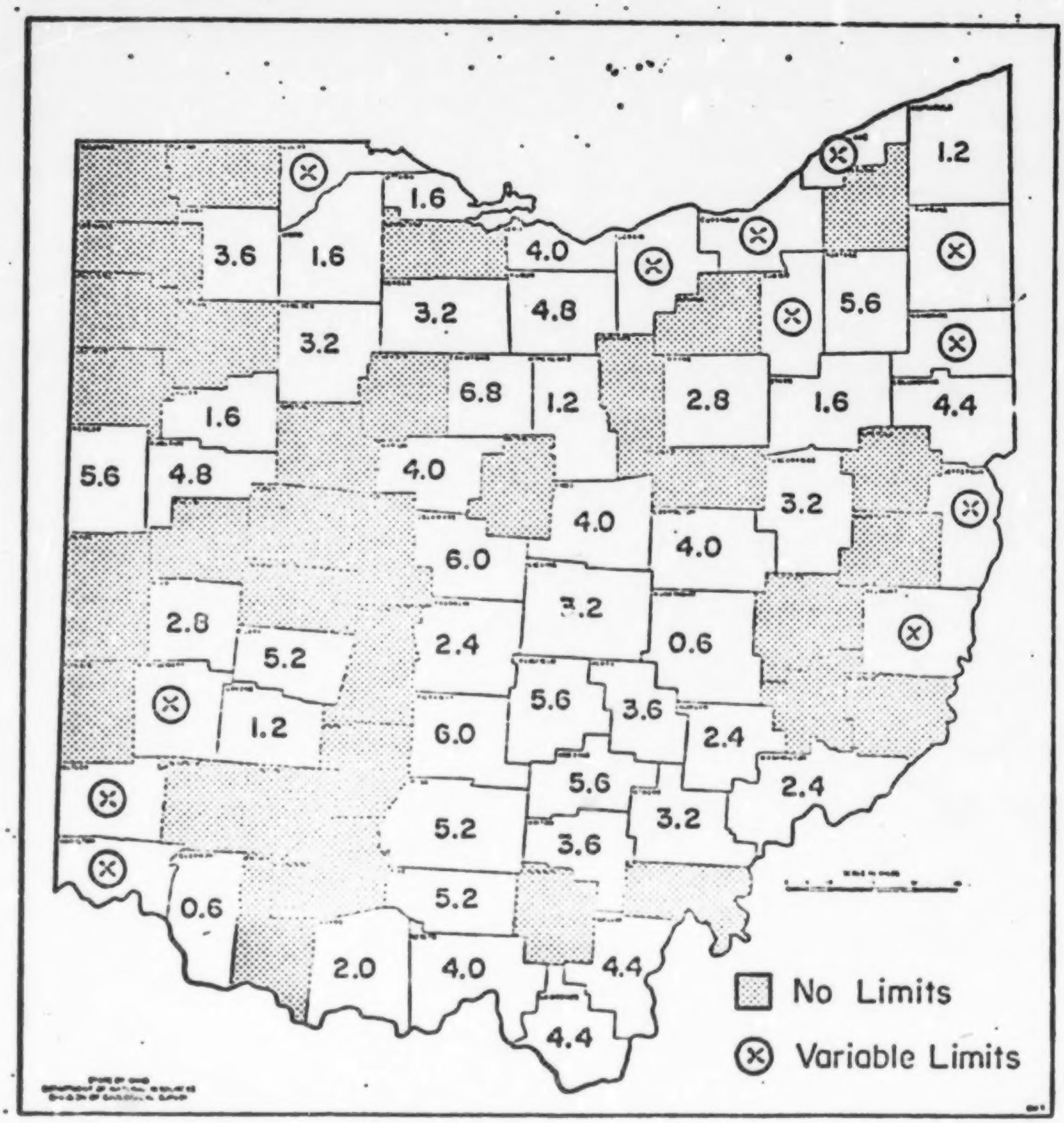
(b) $E = 16.71\ Q_m^{-0.329}$

(c) Size groups are < 50; 50-1500; and >1500 x 10^6 Btu/hour

(d) $E = 5.33\ Q_m^{-0.204}$

(e) $E = 6.18 Q_m^{-0.135}$

Appendix A-1 (cont'd)


1.2
1.6
3.6
1.6
4.0
5.6
3.2
4.8
3.2
6.8
1.2
2.8
1.6
4.4
1.6
5.6
4.8
4.0
3.2
4.0
6.0
4.0
2.8
3.2
0.6
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2.4
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1.2
6.0
2.4
5.6
2.4
5.2
3.2
3.6
0.6
5.2
2.0
4.0
4.4
4.4
▨ No Limits
⊗ Variable Limits

ALLOWABLE SO_2 EMISSIONS FOR OHIO COUNTIES

Appendix A-1 (cont'd)

PROCESS REGULATIONS - PROPOSED

General: 19.5 $(p)^{.67}$ = allowable pounds of SO_2 per hour

Where p = tons of process weight rate per hour

Coke Oven Gas: 50 grains H_2S per 100 dscf

Refinery Off Gas: 50 grains H_2S per 100 dscf

APPENDIX A-2

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MMBTU Heat Input)	Industrial Processes	Exceptions and Comments
Adams	Dayton Power & Light Stuart Plant	3.16		Optional compliance equation
Allen	Ford Motor Company	3.40		Steam generation
	Lima State Hospital	5.39		Steam generation
	Vistron Corporation	1.27		Steam generation
	Standard Oil Company			
	Claus Unit		100.00 lbs. SO_2/1000 lbs. of sulfur	
	Catalytic Cracker		.30 lbs. SO_2/1000 lbs. of petroleum products	
	Trolumen Unit		11.00 lbs. SO_2/ton of production	
	Iso Stabilerzers & Split Heaters (B002)		.71 lbs. SO_2/MMBTU input	
	Vac I Heaters		.21 lbs. SO_2/MMBTU input	
	All other units (Boilers & process heaters)		.13 lbs. SO_2/MMBTU input	Proposed Standard - 1.6 (F.C.)
Ashland				Not regulated
Ashtabula	New Jersey Zinc Co.	1.50 (oil)		Steam generation
	Cleveland Electric Illuminating - Ashtabula Power Plant			Steam generation
	Stacks 1, 2, 3	2.40		
	Stack 4	9.10		
	Stack 5	8.20		
	RMI Corporation			
	Metal Reduction Plant	4.80		
	Sodium Plant	2.70		
	General Tire and Rubber Co.	1.30		Proposed Standard - 1.2 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MMBTU Heat Input)	Industrial Processes	Exceptions and Comments
Athens	Columbus & Southern Ohio Power			
	Poston Plant, Stacks 1 & 2	3.94		Optional compliance equation
	Poston Plant, Stack 3	1.20 (NSPS)		
		7.50		Steam generation
				Proposed Standard - 3.2 (F.C.)
Auglaize	Goodyear Tire and Rubber Co.	4.20		Steam generation Proposed Standard - 4.8 (F.C.)
Brown				Not regulated
Butler		1.40	100 grains of H_2S per 100 dscf of COG or 0.5 lbs. SO_2/MMBTU input	Steam generation Proposed Standard - 1.2 - 2.4 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MMBTU Heat Input)	Industrial Processes	Exceptions and Comments
Carroll				Not regulated
Champaign				Not regulated
Clark	Ohio Edison Co. Mad River Plant, Stacks 1,2,3 Mad River Plant, Stacks 4 & 5	 4.62 1.00		Optional compliance equation Proposed Standard - 5.2 (F.C.)
Clermont	Cincinnati Gas & Electric Co. Beckjord Power Plant	 2.02		Optional compliance equation Proposed Standard - .6 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MMBTU Heat Input)	Industrial Processes	Exceptions and Comments
Clinton				Not regulated
Columbiana		4.40		Steam generation Proposed Standard - 4.4 (F.C.)
Coshocton	Columbus & Southern Ohio Power Co. Conesville Plant Stacks 1,2,3 Stack 4	 3.78 1.20 (NSPS)		Optional compliance equation Proposed Standard - 4.0 (F.C.)
Crawford		9.60		Steam generation Proposed Standard - 6.8 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MMBTU Heat Input)	Industrial Processes	Exceptions and Comments
Darke				Not regulated
Defiance				Not regulated
Delaware		4.00		Proposed Standard - 6.0 (F.C.
Erie		1.60	9.50 lbs. SO_2/ton input	Steam generation Proposed Standard - 4.0 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MMBTU Heat Input)	Industrial Processes	Exceptions and Comments
Fairfield	Diamond Power Specialty Co. Crown-Zellerbach Corp. (Number 2 boiler)	6.90 7.00		Proposed Standard - 5.6 (F.C.)
Fayette				Not regulated
Fulton				Not regulated
Gallia	Gavin Power Plant Kyger Creek Power Plant	9.50 8.20		Proposed Standard - 4.4 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Exceptions and Comments
Geauga				Not regulated
Greene			563.3P-0.9027 lbs. SO_2/ton input	General processes
	Wright Patterson Air Force Base			
	Building 271	0.38		
	Building 6770	0.81		
	Building 666	0.33		
	Building 1240	0.79		
	Building 170	0.93		
	Antioch College	6.20 (coal) 1.40 (oil)		
	Central State University	4.33 (Stack 1) .30 (Stack 2)		Proposed Standard - 1.2 (F.C.)
Guernsey				Not regulated
Hancock		5.20		Steam generation
	Northern Ohio Sugar Company	2.50		
				Proposed Standard - 3.2 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Exceptions and Comments
Hardin				Not regulated
Harrison				Not regulated
Henry	Napoleon Power Plant	0.00		Steam generation
		2.10		Steam generation
				Proposed Standard - 3.6 (F.C.)
Highland				Not regulated

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Exceptions and Comments
Hocking				Not regulated Proposed Standard - 5.6 (F.C.)
Holmes				Not regulated
Huron		8.00		Proposed Standard - 4.8 (F.C.)
Jackson				

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Exceptions and Comments
Knox				Not regulated Proposed Standard - 4.0 (F.C.)
Lawrence		1.22 or 235 grains H_2S/100 dscf	1.22 lbs. SO_2/ton or 235 grains H_2S/100 dscf	Steam generation & process heaters
	Marquette Cement		73.00 lbs. SO_2/ton	
	Dayton Malleable Iron			
	Holding furnace		2.00 lbs. SO_2/ton	
	Cupola		5.40 lbs. SO_2/ton	
	Allied Chemical Co. Semet Solvay Division (Tar pro. boilers 1,2,3)	0.86 or 165 grains H_2S/100 dscf		Proposed Standard - 4.4 (F.C.)
Licking		1.50		Steam generation - oil Proposed Standard - 3.2 (F.C.)
Logan				Not regulated

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Exceptions and Comments
Madison				Not regulated
Marion		6.10		Steam generation
			4.20 lbs. SO_2/MBTU	General process
				Proposed Standard - 4.0 (F.C.)
Medina		8.00		Steam generation
Meigs			11.0 Lbs. SO_2/ton input	
				Proposed Standard - 7.6 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Exceptions and Comments
Mercer		8.00		Steam generation
				Proposed Standard - 5.6 (F.C.)
Miami		3.20		Steam generation
	Piqua Municipal Power Plant	4.78		Optional compliance equation
			65.0 lbs. SO_2/ton input	General process
				Proposed Standard - 2.8 (F.C.)
Monroe				Not regulated
Morgan	Muskingum River Power Plant	6.48		Optional compliance equation
				Proposed Standard - 2.4 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Exceptions and Comments
Morrow				Not regulated
Muskingum	Philo Power Plant	1.14		Optional compliance equation
			58.0 lbs. SO_2/ton input	General process
				Proposed Standard - .6 (F.C.)
Noble				Not regulated
Ottawa		5.90		Steam generation
			47.404 $p^{-0.52}$ lbs. SO_2 per hour	General process
				Proposed Standard - 1.6 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Exceptions and Comments
Paulding			43.0 lbs. SO_2/ton input	
Perry				Not regulated
Pickaway	Pickway Power Plant	4.11		Optional compliance equation
		0.85 (oil)		Steam generation
				Proposed Standard - 6.0 (F.C.)
Pike		7.00		General fuel combustion
				Proposed Standard - 5.2 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Exceptions and Comments
Portage				Not regulated
				Proposed Standard - 5.6 (F.C.)
Preble				Not regulated
Putnam				Not regulated
Richland	Westinghouse Electric	4.50		
	Fisher Body Dio-GMC	3.10		
	Shelby Municipal Power Plant	9.30		
			7.10 lbs. SO_2/ ton	General process
				Proposed Standard - 1.2 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Exceptions and Comments
Ross	Mead Corporation		4.90 lbs. SO_2/ton solids	
	Stack 1, Boiler 1	0.00		
	Stack 2, Boiler 2	0.00		
	Stack 3, Boiler 3	0.00		
	Stack 4, Chilpalco No. 5	0.00		
				Proposed Standard - 5.2 (F.C.)
Sandusky		7.00		General fuel combustion
	J.E. Baker		48.75 lbs. SO_2/ton	General process
	Woodville Lime Co.		8.48 lbs. SO_2/ton	General process
	Martin Marietta		15.42 lbs. SO_2/ton	General process
	Ohio Lime		17.04 lbs. SO_2/ton	General process
				Proposed Standard - 2.0 (F.C.)
Scioto	Empire Detroit Steel		800 grains/100 dscf or 4.1 lbs. SO_2/MBTU option	COG combustion (H_2S)
		0.60 (oil) 6.90 (coal)		
				Proposed Standard - 4.0 (F.C.)
Seneca		1.20 (oil)		Steam generation
		8.20 (coal)		Steam generation
	Union Carbide		552 lbs. SO_2/ton	Calcining Furnace
			176 lbs. SO_2/ton	Activating Furnace
			34.0 lbs. SO_2/ton	General process
				Proposed Standard - 3.2 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MMBTU Heat Input)	Industrial Processes	Exceptions and Comments
Shelby				Not regulated
Tuscarawas	Dover Municipal Plant	4.80	37.80 lbs. SO_2/ton	General process Steam generation Proposed Standard - 3.2 (F.C.)
Union				Not regulated
Van Wert				Not regulated

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MMBTU Heat Input)	Industrial Processes	Exceptions and Comments
Vinton		4.80		Steam generation Proposed Standard - 3.6 (F.C.)
Warren				Not regulated
Washington	Muskingum River Power Plant Shell Oil Co.	6.48 2.50		Optional compliance regulation Proposed Standard - 2.4 (F.C.)
Wayne	Morton Salt Company Packaging Corp. of America Orrville Municipal Power Plant	7.00 7.00 7.00		Proposed Standard - 2.8 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - RURAL COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Exceptions and Comments
Williams				Not regulated
Wood		1.10	1.10 lbs. SO_2/MBTU	Steam generation and processed fuel Proposed Standard - 1.6 (F.C.)
Wyandot				Not regulated

SUMMARY OF PROMULGATED REGULATIONS - URBAN COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Comments
Belmont	Wheeling Pittsburgh Steel Co. Martins Ferry Plant	2.6		Proposed Standard - 1.2 - 6.0 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - URBAN COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Comments
Cuyahoga		$7.014Q_m^{-.3014}$		Steam generation Between 10 and 350 MBTU rated capacity
		1.20		Steam generation Over 350 MBTU rated capacity
			170 grains H_2S/ 100 dscf	Combustion of coke oven gas
			6.0 lbs. SO_2/ton input	Industrial process
	Allied Chemical Company		4.8 lbs. SO_2/ton 100% acid produced	Sulfuric acid plants
	Republic Steel		240 grains H_2S/ 100 dscf or 1.22 lbs. SO_2/MBTU	Combustion of coke oven gas at the following facilities: 1. BOF Shop 2. OH Shop 3. Misc. blast furnaces 1, 4 and 5 4. Foundry 5. P Anneals 1-4 6. Car Thaw 1-1 through 1-4
	OH Precipitator, Units 111 & 112	0.00		
	98 inch slab furnace, Units 1 - 5	0.00		
	84 inch slab furnace, Units 1 & 2	0.00		
	Sinter Plant	0.00		
	Boilers 234, 1, 2, A, B, & C	1.00		
	Lake Shore Power Plant (CEI)			
	Unit 18	1.30		
	Units 91 - 94	1.90		
	Cleveland Pumping Station (Boiler)	4.20		
	Hamilton Avenue Steam Plant (Boiler) (CEI)	1.00		
	Addressograph			
	Boilers 1, 2 and 3	1.00		

SUMMARY OF PROMULGATED REGULATIONS - URBAN COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Comments
Cuyahoga (Con't)	General Electric Boilers 1 and 2	1.00		
	Jones & Laughlin Steel Boiler 30 Boilers 22, 24-29, 31-35	1.00 0.50		
	U.S. Steel (Cuyahoga-Lorain Works) Boilers 1 - 6	0.50		
	(Cuyahoga Works) Boilers 3 - 7	1.30		
	Dupont Boiler 18	0.50		
	Harshaw Chemical Boilers 7 and 8	0.50		
	Standard Oil of Ohio Boilers 7, 9, 10	0.50		
	Hupp Boilers 1 through 3	3.50		
	Chase Bay Boilers 1 and 2	4.20		
	General Electric Boilers 3 and 5	3.10		
	General Motors (Fisher body) Boilers 7, 8, 9	2.10		
	Medical Center Boilers 3 - 8	4.60		

SUMMARY OF PROMULGATED REGULATIONS - URBAN COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Comments
Cuyahoga (Con't)	Ford Motor Company (Stamping Plant) Boilers 1, 2, 3	1.20		
	Ford Motor Company (Engine Plant Number 2) Boilers 1 - 5	4.20		
	Highland View Hospital Boilers 1 and 2	1.50		
	Boilers 3 and 4	2.90		
	Dupont		10 lbs. SO_2/ton 100% acid produced	Sulfuric Acid Plant
	Harshaw Chemical		1.90 SO_2/ton of processed weight	
				Proposed Standard - 1.2 - 6.0 (F.C.)
Franklin		$8.0880Q_m^{-0.4307}$ (1.5-3.0)		Steam generation Between 10 and 50×10^6 MBTU rated capacity
		1.50		$\geq$ 50 MBTU rated capacity for steam generation
			2.4	General process
			$0.564x^{0.85}$ (Lbs. SO_2/hour)	Zinc smelter
	Columbus State Institution	3.80		Steam generation
	Columbus State Hospital	4.10		Steam generation
	Ross Laboratory	4.80		Steam generation
	Rickenbacker Air Force Base	2.20		Steam generation
	Capital City Products	3.10		Steam generation
	Westinghouse Electric	2.20		Steam generation
	Naval Weapons Industrial Reserve	1.06		Steam generation
				Proposed Standard - 2.4 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - URBAN COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Comments
Hamilton		2.00		Steam generation
			0.20 lbs. SO_2/ 1000 lbs. charging stock	Catalytic crackers
			21.0 lbs. SO_2/ ton of 100% acid	Sulfuric acid plant
	Miami Fort Power Plant			
	Stack 2	0.30		
	Stacks 3 & 4	3.30		
	Stack 5	5.50		
	Stack 6	1.20 (NSPS)		
				Proposed Standard - 1.2 - 2.4 (F.C.)
Jefferson		1.80		Steam generation - coal
		0.80		Steam generation - oil
			50 grains H_2S/ 100 dscf	Coke oven gas limitation
	Kaul Clay Co.	2.82		
	Toronto Paper Board Co.	5.96		
	Toronto Power Plant	8.10		
	Sammis Power Plant	2.91		Optional compliance equation
	Cardinal Power Plant	4.76		Optional compliance equation
	Tidd Power Plant	1.58		Optional compliance equation
	Yorkville Steel Plant (Wheeling Pittsburgh Steel)	4.20		
				Proposed Standard - 1.2 - 6.0 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - URBAN COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Comments
Lake		$14.976Q_m^{-0.3431}$		Between 10 and 1000 MBTU rated capacity
		1.40		$\geq$ 1000 MBTU rated capacity
	Ohio Rubber Co.	6.00		
	Painesville Mun. Power Plant			Steam generation
	Boilers 1 - 4	5.20		
	Boiler 5	1.20 (NSPS)		
	Diamond Shamrock	0.00		Steam generation
	East Lake Power Plant	1.4		Steam generation Optional compliance equation
	Lubrizol Corp.		20.0 lbs. SO_2/ ton input	
				Proposed Standard - 1.2 - 6.9 (F.C.)
Lorain		$21.176Q_m^{-0.5477}$		Steam generation Between 10 and 100 MBTU rated capacity
		1.70		$\geq$ 100 MBTU rated capacity
	Avon Lake Power Plant	1.15		Steam generation Optional compliance equation
	Edgewater Power Plant	3.40		Steam generation
	United States Steel Corp.			
	Processess P033 & P039		35 grains H_2S/ 100 dscf or 0.10 lbs. SO_2/MBTU	COG limitation
	All other processess		75 grains H_2S/ 100 dscf or 0.40 lbs. SO_2/MBTU	COG limitation
	Boilers 1 - 9			Steam generation
	Boilers 10 - 13			Steam generation

SUMMARY OF PROMULGATED REGULATIONS - URBAN COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MMBTU Heat Input)	Industrial Processes	Comments
Lorain (Con't)	General Motors			
	Boilers 1 & 2	0.80		Steam generation - oil
	Boiler 4	0.90		Steam generation - oil
				Proposed Standard - 1.2 - 6.0 (F.C.)
Lucas		1.50		Steam generation - coal
		1.00		Steam generation - oil
	Bayshore Station	1.30 (coal) 0.40 (oil)		
	Acme Power Plant	2.00 (coal) 0.80 (oil)		
	Standard Oil of Ohio			
	Boilers & process heaters	0.50	0.50	
	P001		#6 grains H_2S/ 100 dscf	Refinery off-gas combustion
	P002		0.3 lbs. SO_2/1000 lbs. input	Catalytic cracking units
	P003		0.11 lbs. SO_2/ ton input	General process

SUMMARY OF PROMULGATED REGULATIONS - URBAN COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MMBTU Heat Input)	Industrial Processes	Comments
Lucas (Con't)	Coulton Chemical Company	0.30		Steam generation
			6.5 lbs. SO_2/ton acid produced	Sulfuric Acid Plant
	Gulf Oil	0.30		
	P003		0.30 lbs. SO_2/1000 lbs. charging stock	Catalytic cracking units
	P005		64.4 lbs. SO_2/ 1000 lbs. sulfur	Sulfur recovery
	Toledo Edison Co.			
	Water Street Steam Plant	0.80		
	Phillips Petroleum Co.			
	Toledo Philblack Plant	0.80		Steam generation
			5.45 lbs. SO_2/ton input	General process
	Interlake Steel	0.80		Steam generation
			4.93 lbs. SO_2/ton input	General process
	Nabisco	1.20		
	Sun Oil	0.50	0.50	Steam generation & process heaters
			2.0 lbs. SO_2/ton input	General process
	Toledo Hospital	3.50		
	Seneca Petroleum	1.20		
				Proposed Standard - 1.2 - 6.0 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - URBAN COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Comments
Mahoning		0.50		Steam generation
			1.00 lbs. SO_2/ton input	General process
			100 grains H_2S/100 dscf or 0.50 lbs. SO_2/MBTU	COG combustion limitation
	Ohio Edison Co. North Avenue Steam Plant	2.00		Steam generation
	Lonardo & Sons Greenhouse	2.00		
	Whitmore-Greer Fireproofing		20 lbs. SO_2/ton input	
				Proposed Standard - 1.2 - 6.0 (F.C.)
Montgomery		1.60		Steam generation
	Dayton Power and Light Co.			
	Longworth Street Station	0.65		Steam generation - oil
	Third Street Station	0.65		Steam generation - oil
	Yankee Substation	0.65		Steam generation - oil
	Monument Substation	0.65		Steam generation - oil
	Tait Power Plant	1.25		Steam generation - coal
		0.65		Steam generation - oil
	Hutchings Power Plant	1.20		Steam generation - coal
		0.65		Steam generation - oil
	Delco Corp.	1.30		Steam generation
	Defense Electronics Supply	0.95		Steam generation
			2.6 lbs. SO_2/ton input	General process
				Proposed Standard - 1.6 - 3.0 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - URBAN COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Comments
Stark		$10.48Q_m^{-0.4286}$ (2.5-6.0)		Between 10 and 60 MBTU rated capacity Steam generation
		2.50		≥ 60 MBTU rated capacity
			350 grains H_2S/100 dscf or 1.70 lbs. SO_2/MBTU	COG combustion limitation
			80 lbs. SO_2/ton input	Industrial process
	Republic Steel Corp. Massillon facilities	4.40		Steam generation
	Massillon State Hospital	5.20		
	Grief Board Company	0.50		
	Timken Steel Company	1.20		Steam generation - coal
		0.60		Steam generation - oil
	Ashland Oil Company			
	4-16-8-11 and 4-3-8-6 ✓	1.20		
	Remaining stacks	→ 0.85		
	Catalytic Cracker		97.5% SO_2 removal efficiency	
				Proposed Standard - 1.6 (F.C.)

SUMMARY OF PROMULGATED REGULATIONS - URBAN COUNTIES

County	Named Facility	Fuel Combustion (Lbs. SO_2/MBTU Heat Input)	Industrial Processes	Comments
Summit		$17.55Q_u^{-0.3593}$ (1.8-7.0)		Between 10 and 300 MBTU rated capacity
		1.80		≥ 300 MBTU rated capacity
	Diamond Crystal	6.10		Steam generation
	Akwell Industries	3.00		Steam generation
	Ohio Brass Co.	4.20		Steam generation
	Sieberling Tire & Rubber Co.	1.00		Steam generation
	Firestone Tire & Rubber Co.	1.50		Steam generation
	Goodrich Tire & Rubber Co.	1.90		Steam generation
	Goodyear Tire & Rubber Co.	1.00		Steam generation Steam generation
			100 lbs. SO_2/1000 lbs. sulfur processed	Sulfur recovery
	Tecumseh Co.	1.70		Steam generation - coal
		0.70		Steam generation - oil
	Ohio Edison Co.			
	Beech Street Power Station	4.10		
	Gorge Power Plant	2.10		
			17.0 lbs. SO_2/ ton input	General process
				Proposed Standard - 1.2 - 6.0 (F.c.)
Trumbull		3.00		Steam generation - coal
		1.00		Steam generation - oil
	Republic Steel Co.			
	Unit B001	0.20		Steam generation
	Process operation P001	1.00		
			300 grains H_2S/ 100 dscf	COG combustion
			2.00 lbs. SO_2/ MBTU input	General process
	Ohio Edison Co.			
	Niles Power Plant	5.41		Optional compliance equation
	U.S. Steel Corporation McDonald Mills	0.50		

APPENDIX B

1. OHIO MANUFACTURING ESTABLISHMENTS: SUMMARY NUMBERS
2. OHIO INDUSTRIAL VALUE OF SHIPMENTS
3. OHIO INDUSTRIAL VALUE OF SHIPMENTS: SIC SUMMARY
4. CITY/COUNTY SUMMARY OF MANUFACTURING ESTABLISHMENTS
5. OHIO INDUSTRIAL COAL CONSUMPTION: SUMMARY NUMBERS

Appendix B-1

OHIO MANUFACTURING ESTABLISHMENTS

SUMMARY NUMBERS

SIC	Number of Establishments (Ohio)	Number of Establishments (US)	Ohio as % of National
20	1,259	28,184	4.47
21	7	272	2.57
22	72	7,203	1.00
23	352	24,438	1.44
24	814	33,948	2.40
25	311	9,232	3.37
26	368	6,038	6.09
27	1,917	24,102	4.55
28	701	11,425	6.14
29	170	2,016	8.43
30	772	9,237	8.36
31	64	3,201	2.00
32	1,035	16,015	6.46
33	653	6,792	9.61
34	2,178	29,525	7.38
35	3,347	40,792	8.21
36	574	12,274	4.68
37	445	8,802	5.06
38	293	5,987	4.89
39	576	15,188	3.77
TOTAL	16,396	320,710	5.11

SOURCE: 1972 Census of Manufactures (MC72(3)-36), Area Series, Ohio, Table 5, pp. 36-11-36-17.

1972 Census of Manufactures (MC72(1)-1), Subject Series General Summary, Table 3, pp. 1-36 - 1-51.

Appendix B-2

OHIO INDUSTRIAL VALUE OF SHIPMENTS

SIC	$(10^6\$)$2/ Ohio Value of Shipments	$(10^6\$)$2/ U.S. Value of Shipments	Ohio as % of National
20	4,867.6	115,060.3	4.23
21	1/	5,920.2	1.86
22	302.6	28,071.5	1.08
23	674.2	27,908.2	2.42
24	466.6	23,816.0	1.96
25	493.7	11,308.6	4.37
26	1,447.0	28,216.9	5.12
27	1,801.8	30,132.4	5.98
28	3521.4	57,349.6	6.14
29	1,322.0	28,694.7	4.61
30	3,597.6	20,923.7	17.19
31	1/	5,769.5	1.91
32	2,024.2	21,537.5	9.40
33	7,339.3	58,429.7	12.56
34	6,081.5	51,739.3	11.75
35	6,858.1	65,820.7	10.42
36	3,960.1	53,433.0	7.41
37	9,171.7	94,704.9	9.68
38	461.4	15,565.7	2.96
39	480.7	12,185.9	3.94
TOTAL	55,056.5	756,534.3	7.28

1/ Industries 21 and 31 together represent approximately .4% of the Ohio total, therefore, a value of 110.1 million dollars (.2%) was used for both to determine their percentage of national value of shipments.

2/ 1975 dollars.

SOURCE: 1972 Census of Manufactures (MC72(3)-36), Area Series, Ohio, Table 5, pp. 36-11 - 36-17.

1972 Census of Manufactures (MC72(1)-1), Subject Series, General Summary, pp. 1-36 - 1-51.

Appendix B-3

OHIO INDUSTRIAL VALUE OF SHIPMENTS

SIC SUMMARY

SIC	$(10^6\$)$ 2/ Ohio Value of Shipments	SIC as % of Ohio
20	4867.6	8.84
21	1/	.20 1/
22	302.6	.55
23	674.2	1.22
24	466.6	.847
25	493.7	.897
26	1447.0	2.63
27	1801.8	3.27
28	3521.4	6.40
29	1322.0	2.40
30	3597.6	6.53
31	1/	.20 1/
32	2024.2	3.68
33	7339.3	13.33
34	6081.5	11.05
35	6858.1	12.46
36	3960.1	7.19
37	9171.7	16.66
38	461.4	.838
39	480.7	.873
TOTAL	55056.3	100.00

1/ Industries 21 and 31 together represent approximately .4% of the Ohio total, therefore, a value of 110.1 million dollars (.2%) was used for both to determine their percentage of national value of shipment.

2/ 1975 dollars

SOURCE: 1972 Census of Manufactures (MC72(3)-36), Area Series, Ohio, Table 5, pp. 36-11 - 36-17.

Appendix B-4

CITY/COUNTY SUMMARY OF MANUFACTURING ESTABLISHMENTS

City	Number of Establishments	City as % of Ohio
Akron	391	2.38
Canton	209	1.27
Cincinnati	960	5.86
Cleveland	2336	14.25
Columbus	740	4.51
Dayton	508	3.10
Toledo	662	4.04
Youngstown	150	0.91

Urban County	Number of Establishments	Urban County as % of Ohio
Belmont	74	.451
Cuyahoga	3691	22.51
Franklin	980	5.98
Hamilton	1670	10.19
Jefferson	61	.372
Lake	399	2.43
Lorain	306 1/	1.87
Lucas	773	4.71
Mahoning	337	2.06
Montgomery	865	5.28
Stark	551	3.36
Summit	793	4.84
Trumbull	266	1.62
TOTAL	10,766	65.67

1/ Includes Elyria

SOURCE: 1972 Census of Manufactures (MC72(3)-36), Area Series, Ohio, Tables 7 (county data) and 8 (city data), pp. 36-29 - 36-44.

Appendix B-5

OHIO INDUSTRIAL COAL CONSUMPTION

SUMMARY NUMBERS

SIC	(10^3 Short Tons) Ohio Coal Consumption	SIC As % of Ohio	US Coal Consumption	Ohio SIC as a % of National
20	318.1	3.01	4456.1	7.15
22	15.3	.145	1545.8	.99
24	.6	.006	184.3	.326
25	3.6	.034	225.1	1.60
26	1409.9	13.36	9439.0	14.95
27	13.0	.123	17.6	73.86
28	2265.5	21.47	18323.6	12.36
29	35.2	.334	358.4	9.82
30	973.9	9.23	1243.9	78.29
31	8.0	.076	115.6	6.92
32	1452.8	13.77	9708.7	14.96
33	2907.4	27.55	9462.4	30.73
34	262.3	2.49	649.6	40.38
35	312.8	2.96	1214.9	25.75
36	113.7	1.08	685.9	16.57
37	433.9	4.11	2609.7	16.63
39	25.6	.243	79.7	32.12
TOTAL	10,551.6		61,392.6	

SOURCE: Column 1: 1972 Census of Manufactures (MC72(SR)-6), Special Report Series, Fuels and Electric Energy Consumed, Table 4, pp. SR6-28 - SR6-47.

Column 3: 1972 Census of Manufactures (MC72(SR)-6), Special Report Series, Fuels and Electric Energy Consumed, Table 3, pp. SR6-10 - SR6-27.

APPENDIX C

1. MANUFACTURING SIC DESCRIPTION
2. BOILER PLANTS COSTED
3. GENERAL PROCESSES
4. FUEL GAS BURNING PROCESSES

Appendix C-1

MANUFACTURING S.I.C. DESCRIPTION

SIC	INDUSTRY
20	Food and Kindred Products
21	Tobacco Products
22	Textile Mill Products
23	Apparel, Other Textile Products
24	Lumber and Wood Products
25	Furniture and Fixtures
26	Paper and Allied Products
27	Printing and Publishing
28	Chemicals and Allied Products
29	Petroleum and Coal Products
30	Rubber, Miscellaneous Plastics Products
31	Leather and Leather Products
32	Stone, Clay and Glass Products
33	Primary Metals Industries
34	Fabricated Metal Products
35	Machinery, except Electrical
36	Electric, Electronic Equipment
37	Transportation Equipment
38	Instruments, Related Products
39	Miscellaneous Manufacturing Industries

APPENDIX C-2

BOILER PLANTS COSTED, BY SIC

SIC	# of Plants
20	14
22	2
24	0
25	4
27	1
28	19
29	5
30	14
31	0
32	8
33	28
34	13
35	10
36	8
37	12
39	2
47	1
49	3
65	1
90	49
99	31
	250

APPENDIX C-3

GENERAL PROCESSES

Ohio ID Number	Name	SIC	Stack	In Compliance w/Regulation		No Data	No Regulation In County	Cost Development for Regulation	
				11/75	8/76			11/75	8/76
18001007	Harshaw Chemical	2800	1	Yes	No	x		No	No
48040150	Northern Ohio Asphalt Paving	2951	1			x		No	No
51010009	Ohio Road Paving	2951	1			x		No	No
77130000	McCort Construction	2951	1			x		No	No
			2			x		No	No
77010192	Goodyear Tire & Rubber	3011	1	No	Yes	x		No	No
45020185	Owens Corning	3229	1			x		No	No
60000010	Columbus Cement	3241	1	No	Yes			Yes	No
63000002	General Portland Cement	3241	1		Yes		(11/75) x	No	No
			2		Yes		x	No	No
72000081	J.E. Baker - Millersville	3241	1		Yes		(11/75) x	No	No
76000074	Flintkote	3241	1			x		No	No
			2	No	Yes			Yes	No
			3	No	Yes			Yes	No
			4	No	Yes			Yes	No
77020000	PPG Industries	3241	1	No		(8/76) x	(8/76) x	Yes	No
			2	No			x	Yes	No
50000005	Whiteacre - Greer	3255	1	No	Yes	x		No	No

APPENDIX C-3 CONTINUED

Ohio ID Number	Name	SIC	Stack	In Compliance w/Regulation 11/75	In Compliance w/Regulation 8/76	No Data	No Regulation In County	Cost Development for Regulation 11/75	Cost Development for Regulation 8/76
22010062	Huron Lime Company	3274	1	Yes	Yes			No	No
			2	Yes	Yes			No	No
			3	Yes	Yes			No	No
29060018	Southwest Portland Cement	3274	1	No	Yes	x		No	No
			2	Yes	Yes			No	No
29700088	Universal Atlas Cement	3274	1	No	Yes	x		No	No
			2	No	Yes	x		No	No
			3	No	Yes	x		No	No
			4	No	Yes	x		No	No
43020456	Diamond Shamrock Chemical	3274	1	Yes	Phased Out			No	No
43030257	Republic Steel	3274	1	No			(8/76) x	Yes	No
			2	No			x	Yes	No
62000079	U.S. Gypsum Company	3274	1	Yes	Yes			No	No
			2	No	Yes	x		No	No
	Globe Steel	3274	1	Yes	Yes			No	No
72000104	Ohio Lime	3274	1		Yes		(11/75) x	No	No
			2		Yes		x	No	No
			3		Yes		x	No	No
			4		Yes		x	No	No
			5		Yes		x	No	No
72000127	Martin Marietta	3274	1		Yes		(11/75) x	No	No
			2		Yes		x	No	No

APPENDIX C-3 CONTINUED

Ohio ID Number	Name	SIC	Stack	In Compliance w/Regulation 11/75	In Compliance w/Regulation 8/76	No Data	No Regulation In County	Cost Development for Regulation 11/75	Cost Development for Regulation 8/76
72000147	Woodville Lime	3274	1		Yes		(11/75) x	No	No
18270383	Hydraulic Press Brick	3295	1	Yes	Yes			No	No
76000771	Glen-Gery Inc.	3295	1			x		No	No
			2			x		No	No
			3			x		No	No
			4			x		No	No
			5			x		No	No
79000014	Fairfield Brick	3295	1	No	Yes	x		No	No
			2	No	Yes			No	No
18000078	Jones & Laughlin Steel	3312	1	Yes	Yes			No	No
			2	Yes	Yes			No	No
18001622	U.S. Steel Corp.	3312	1			x		No	No
			2	Yes	Yes			No	No
41090010	Wheeling-Pittsburgh Steubenville-South	3312	1			x		No	No
41150011	Wheeling-Pittsburgh Steubenville-South	3312	1			x		No	No
50110469	U.S. Steel	3312		Yes	No	x		No	No
70010023	Empire - Detroit Steel	3312	1	Yes	Yes			No	No
50110242	Youngstown Sheet and Tube-Brier Hill Works	3312	1			x			

APPENDIX C-3 CONTINUED

Ohio ID Number	Name	SIC	Stack	In Compliance w/Regulation 11/75	In Compliance w/Regulation 8/76	No Data	No Regulation In County	Cost Development for Regulation 11/75	Cost Development for Regulation 8/76
18120180	Ford Motor Company	3321	1	Yes	Yes			No	No
			2	Yes	Yes			No	No
			3	Yes	Yes			No	No
25040043	Dayton Malleable Iron	3322	1			x		No	No
18000222	National Lead Inc.	3332	1	Yes	No			No	Yes
25040002	Asarco	3341	1			x		No	No
			2			x		No	No
			3			x		No	No
76000475	Canton Metal Alloys	3341	1	No	Yes			Yes	No

APPENDIX C-4

FUEL GAS BURNING PROCESSES

1. Oil Refineries

Company	City	County
Sun Oil Company	Toledo	Lucas
Standard Oil of Ohio	Toledo	Lucas
Ashland Oil Company*	Findlay	Hancock
Gulf Oil Company	Cleves	Hamilton
Gulf Oil Company	Toledo	Lucas
Standard Oil of Ohio	Lima	Allen
Ashland Oil Company	Canton	Stark

*deleted as a non-process refinery.

2. Steel Mills

Company	County
Allied Chemical	Lawrence
Youngstown Sheet & Tube - Campbell Works	Mahoning
Empire Detroit Steel	Scioto
U.S. Steel Corp. - Lorain/Cuyahoga Works	Lorain
Republic Steel	Cuyahoga
Republic Steel	Trumbull
Armco Steel - Hamilton	Butler
Armco Steel - Middleton	Butler
Republic Steel	Mahoning
Republic Steel	Stark
Interlake, Inc.	Lucas

APPENDIX D

SCREENING METHODOLOGY

1. OVERVIEW

2. GENERAL METHODOLOGY
   - a. First Screening Step
   - b. Data Checks and Recosting
   - c. Second Screening Step in Price Impact Analysis
   - d. Second Screening Step in Financial Impact Analysis

3. DETAILED METHODOLOGY
   - a. First Screening Step
   - b. Data Checks of Recosting
   - c. Second Screening Step in Price Impact Methodology
   - d. Second Screening Step in Capital Impact Methodology

TABLES

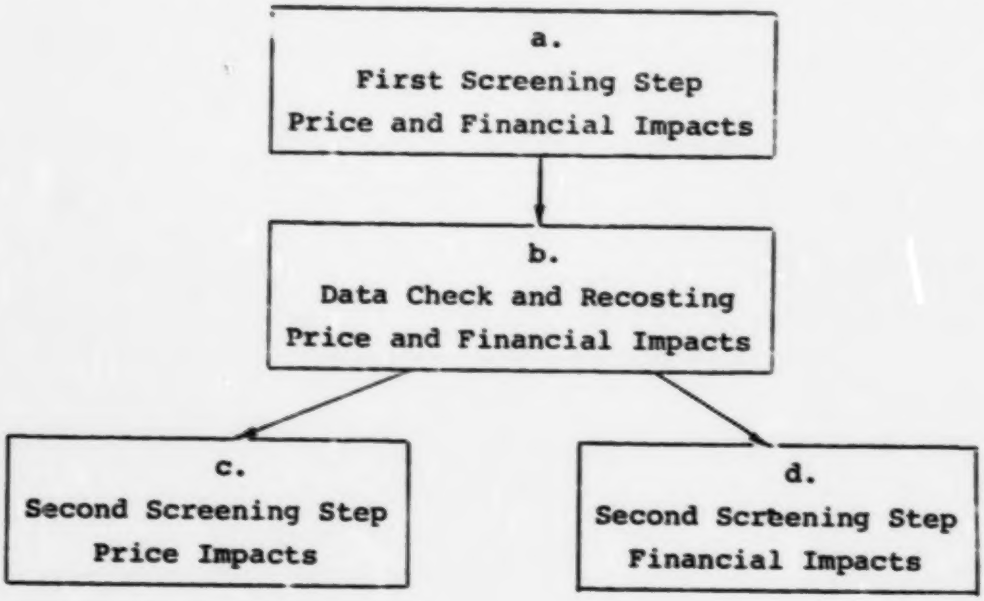
1. Price Impacts by Industry for Proposed and Final Regulations
2. Average Price Impacts by Industry
3. Distribution of Price Impacts by Industry for the Proposed Regulation
4. Distribution of Price Impacts by Industry for the Final Regulation
5. Average Financial Impacts by Industry
6. Distribution of Capital Impacts by Industry for the Proposed Regulation
7. Distribution of Capital Impacts by Industry for the Final Regulation

APPENDIX D

SCREENING METHODOLOGY

1. Overview

This Appendix presents the screening steps that are followed in order to determine the economic effects of the two regulations. The data used in the screening methods are found in Appendix E. Two different paths were followed to identify the industries that may experience either price or financial impacts (or both). The following flow chart explains the progression of the following discussion of the steps taken to screen the price and financial impacts.


a.
First Screening Step
Price and Financial Impacts
b.
Data Check and Recosting
Price and Financial Impacts
c.
Second Screening Step
Price Impacts
d.
Second Screening Step
Financial Impacts

The first screening step, step a., is outlined in Section V for both price and financial impact. The second step, step b., involves a data check, specifically emissions and energy use data and this step also affects the results of both the price and financial impact analysis. This step is performed on plants which initially chose FGD or low sulfur oil as a method of compliance.

The screening steps now diverge for investigating price and financial impacts. Step c. attempts to verify or correct the fuel consumption pattern of the plants as compared to the aggregate industries. This step is performed for all plants which expect price impacts greater than 1 percent as determined by the first screening step, step a.

The financial impact analysis is screened further in step d., which examines the corporate impacts. This is performed on all plants which expect to incur an increase in their capital budget of greater than 5 percent.

This appendix is divided into two main sections. The first describes the general methodology of the screening steps, and the second section is concerned with presenting the detailed steps taken.

2. General Methodology

a. First Screening Step

As described in Section V, the approach of the initial screening step is to choose evaluation criteria which tend to possibly overstate the impacts, but will insure that no impacted plants will be overlooked.

In terms of the price impact analysis, the estimated economic impact is first screened by assuming that all annualized control costs are passed on as price increases. The percentage price increases are estimated by comparing the costs to plant-level sales data. The conservative nature of the first screening is distinguished by the choice of aggregate industry data used to calculate the plant-level sales. Specifically, the fuel consumption patterns of the plant and the industry were implicity assumed to be the same which is not the case. Therefore, the use of total industrial energy consumption data for boilers will tend to understate the energy/sales ratio at the plant-level when the plants only burn coal, thus overstating the price impacts.

For the financial impact analysis, the first screening step is conducted at the plant level to insure the inclusion of any possible financial impacts. The result is to identify any plants which would incur significant increases in their capital budget requirements. Since the realistic impact occurs at the corporate level, this plant level approach, along with the conservative nature of the first screening step parameters, will expose all potential industry financial impacts.

Energy consumption (or production) data were available for the plant and were used in the following formula to estimate the budget:

$$\text{Plant Capital Budget} = \frac{\text{Industry-wide Annual Capital Expenditure}}{\text{Industry-wide Energy Consumption}} \times \text{Plant Energy Consumption}$$

This screening ratio generates a "normal" level of investment at the plant. Incremental capital costs are then compared to this "normal" level to determine whether pollution control costs constitute a significant increase in demand for investment.

In reality, of course, normal investment at a plant level has no operational meaning since in years when major modifications are made it will be high while in other years only necessary replacement expenditures will be incurred. The use of this "normal" level of plant investment here depicts a one-plant corporation with the same ratio of investment to sales as its national four digit industry. Although a significant increase in capital costs for this one-plant firm may in fact be insignificant if the plant is a part of a large, multi-plant corporation, this approach insures that any possible impacts will be identified at this screening step. Once potentially impacted plants are identified, the effects are then evaluated using consolidated financial data at the corporate level.

The results of the first screening step can be found in Tables D-1, to D-4 for the price impact analysis, and Tables D-5 to D-7 for the financial impact analysis. These tables present the magnitude, distribution, and average of the impacts by industry for both regulations.

A look at Table D-2, which summarizes the average price impacts for each industry, reveals to what extent the two regulations affect the industries differentially. Briefly, 7 industries at the 2-digit specification are impacted less by the final regulation, while 6 are affected more severely. For those industries at the 4 digit level of specification that tend to incur high impacts, the average impacts tend to be lower for the final regulation than for the proposed regulation due to a general relaxation of the regulations for process sources.

From Table D-1, under the proposed regulations, industries that incur price impacts above 1 percent include SIC 30 (Rubber, Plastics), SIC 32 (stone, clay, glass), SIC 33 (Primary Metals), and a few institutions. They total 25 plants out of 100 that had non-zero price impacts. For the final regulation, only 13 plants incurred price impacts greater than one percent. These included plants in the following industries:

Paper Products,
Chemicals,
Petroleum Productions,
Rubber,
Primary Metals,

and three institutions.

More specifically, those industries that incurred large price impacts from the final regulation include:

Sulfuric Acid
Rubber Products
Steel Making
Iron and Metal Forgings
Alkalies and Chlorine
Paperboard
Non-manufacturing Institutions

In reference to Tables D-3 and D-4, the distribution of the price impacts within each industrial classification emphasizes the comparison of the effects of the regulations. More plants incur price impacts of greater that 5 percent for the proposed regulation (10 plants) than for the final regulation (4 plants).

Most of the industries covered by the regulations do not incur capital impacts due to their methods of compliance as described in Section IV. Average impacts for firms out of compliance are shown in Table D-5 (ratio of incremental to "normal" investment at the plant level).

Under the proposed regulation, impacted plants are in the following 5 industries:

Sulfuric Acid
Petroleum Refining
Fabricated Rubber Products
Steel Blast Furnaces
Secondary Non-Ferrous Metals

Under the final regulation fewer plants were financially impacted but they represented more industries including:

Sulfuric Acid
Petroleum Refining
Steel Blast Furnaces
Tires and Inner Tubes
Motor Vehicles
Primary Lead

Tables D-6 and D-7 show the distribution of impacts for each industry group for the proposed and final regulations respectively. The tables suggest that where capital costs occured, they appeared to be substantial (mostly above 10 percent of the "normal" plant investment level). Under both sets of regulations the most severely impacted plants are in the chemical, petroleum refining and steel industries.

Table D-1

PRICE IMPACTS BY INDUSTRY FOR PROPOSED AND FINAL REGULATIONS

INDUSTRY NAME	FINAL REGULATION		PROPOSED REGULATION	
	PRICE IMPACTS		PRICE IMPACTS	
SIC	>0%	>1%	>0%	>1%
20	3	0	5	0
22	1	0	1	0
25	0	0	0	0
26	3	1	2	0
27	0	0	0	0
28	9	5	12	5
29	6	1	6	0
30	3	1	7	5
32	0	0	6	3
33	17	2	25	4
34	3	0	4	0
35	2	0	2	0
36	6	0	4	0
37	4	0	4	0
39	1	0	0	0
90	9	3	13	8
TOTAL	67	13	91	25
Four Digit Specification				
3312	7	0	7	0
3313	6	0	11	0
2819	4	4	5	5
2911	4	0	5	0
3274	0	0	0	0
3069	1	1	5	5

Table D-1 (continued)

3341	0	0	1	1
3241	0	0	4	3
3399	1	1	2	1
3391	1	1	2	2
TOTAL	24	7	42	17

Table D-2

AVERAGE PRICE IMPACTS BY INDUSTRY

	PROPOSED REGULATION	FINAL REGULATION
SIC	AVERAGE PRICE IMPACTS	AVERAGE PRICE IMPACTS
20	.13	.08
22	.15	.35
25	0	0
26	.14	.06
27	0	0
28	.93	.97
29	.23	.18
30	.26	.73
32	2.2	0
33	.37	.04
34	.01	.04
35	.05	.05
36	.10	.02
37	.03	.13
39	0	.04
90	1.15	.46
Four Digit Specification		
3312	.07	.04
3313	.34	.25
2819	16.9	10.18
2911	.24	.17
3069	3.9	.79
3341	1.23	0
3241	2.33	0
3399	.34	1.32
3391	3.9	1.25

Table D-3

DISTRIBUTION OF PRICE IMPACTS BY INDUSTRY FOR THE PROPOSED REGULATION

	MAGNITUDE OF PRICE IMPACT			
SIC	<1%	1-5%	5-10%	>10%
2819	-	-	1	4
3069	1	2	3	-
3341	-	1	-	-
3241	1	3	-	-
3399	2	1	-	-
3391	0	2	-	-
28	9	-	1	4
30	4	2	3	-
32	3	3	-	-
33	22	4	-	-
90	13	6	1	1

Note: For industries not listed, the plants' price impacts are all less than 1%.

Table D-4

DISTRIBUTION OF PRICE IMPACTS BY INDUSTRY FOR THE FINAL REGULATION

	MAGNITUDE OF PRICE IMPACT			
SIC	<1%	1-5%	5-10%	>10%
2819	-	1	1	2
3069	1	1	-	-
3399	1	1	-	-
3391	-	1	-	-
28	10	2	1	2
30	3	1	-	-
33	19	2	-	-
90	16	2	-	1
26	8	1	-	-
29	6	1	-	-

Note: For industries not listed, the plants' price impacts are all less than 1%.

Table D-5

AVERAGE FINANCIAL IMPACTS BY INDUSTRY

	PROPOSED REGULATION	PROPOSED REGULATION
SIC	AVERAGE FINANCIAL IMPACTS	AVERAGE FINANCIAL IMPACTS
20	0	0
22	0	0
25	0	0
26	0	0
27	0	0
28	18.66	11.76
29	21.49	15.47
30	3.25	30.86
32	0	0
33	18.41	5.64
34	0	0
35	0	0
36	0	0
37	0	6.95
39	0	0
90	0	0
Four Digit Specification		
3312	.92	.64
3313	18.98	14.26
2819	100.+	100.+
2911	23.13	.00
3069	17.52	.00
3341	100.+	.0
3399	.34	0
3391	3.9	0

Table D-6

DISTRIBUTION OF CAPITAL IMPACTS BY INDUSTRY FOR THE PROPOSED REGULATION

DISTRIBUTION

SIC	0.%	<3%	3-10%	10-30%	>30%
28	9	-	-	-	6
29	1	-	-	4	1
30	8	-	-	-	1
33	13	-	1	9	3
2819	-	-	-	-	6
2911	-	-	-	4	1
3069	5	-	-	-	1
3312	6	-	1	-	-
3313	-	-	-	9	2
3341	-	-	-	-	1

Table D-7

DISTRIBUTION OF CAPITAL IMPACTS BY INDUSTRY FOR THE FINAL REGULATION

	DISTRIBUTION				
SIC	0%	<3%	3-10%	10-30%	>30%
28	11	-	-	-	4
29	3	-	-	4	-
30	3	-	-	-	1
33	11	2	2	6	-
37	3	-	-	1	-
2819	-	-	-	-	4
2911	-	-	-	4	-
3011	-	-	-	-	1
3312	7	1	2	-	-
3313	-	-	0	6	-
3711	-	-	-	1	-
3332	-	1	-	-	-

b. Data Checks and Recosting

This step involves a check on the data used in costing the plants which based on Battelle data use FGD or switch to oil as their compliance method under the final regulation. This includes six plants that chose FGD and four which switched to oil. Of those ten plants, one chose FGD under the proposed regulation and none switched to oil.

Discrepancies between data on emissions, sulfur content of fuels consumed, types and quantity of fuels consumed, and number of stacks and boilers were in need of reconciliation. For some of the above plants, direct comparisons were made between Battelle data and the EPA Region V data (supplied through phone conversations).

The Region's data, when available, was substituted in the costing formulas. The plants were recosted under each of the regulations. The results were, in some cases, quite different. Under the final regulation, none of the six plants that chose FGD did so with the corrected data. Four of the six switched to low sulfur oil, one to low sulfur oil and coal, and one was determined to now be in compliance. These changes altered the compliance methods, the number of plants out of compliance, the annual costs of control, and deleted the capital costs due to FGD installations.

Of the four plants that switched to oil, one plant's choice was reinforced by the new data, one switched to low sulfur coal, and the others were not recosted. This is because one plant's regulation is so tight that low sulfur oil is the probable choice and the other is not listed in the Region's data file.

Under the proposed regulation, the one plant that had originally chosen FGD switched his method of compliance to low sulfur coal with the new data.

The revised data also affected the costs of the nine other plants under the proposed regulation. Specifically, changes in energy consumption directly affect the control costs for switching to low sulfur coal.

Since the data check was only conducted for the ten plants that fell in these categories under the final regulation, one other plant that chose FGD under the proposed regulation was not recosted and remains as having chosen this compliance method.

In summary, with the revised data, no plants chose FGD under the final regulations and one did under the proposed. The switch to oil was chosen by two plants under the final regulation, and by none under the proposed. The annual and capital control costs were altered, and in Section IV the tables presenting these figures reflect these changes.

c. Second Screening Step in Price Impact Analysis

After reviewing the results of the first screening step, it was decided to examine more closely the price impacts of a few manufacturing plants. This second screening step involves verifying the fuel consumption pattern of the plants, crucial to the determination of the plant-level sales and budget data, as described in the methodology section in Section V.

From the first screening step, ten manufacturing plants in five industries tentatively would incur impacts greater than one percent under the final regulation. For the proposed regulation, the figures are 17 plants in four industries. The industries potentially affected include:

- Rubber Products
- Primary Metals
- Paper
- Petroleum
- Chemicals
- Stone, clay, and glass (cement)

For most of the plants that are now under consideration in these industries, the energy consumption data is the plant specific input to the equation used to estimate plant-level sales. The exceptions are the sulfuric acid plants in the chemicals industry, where production figures were substituted. For the cement industry, coal consumption was already used yielding an accurate representation of plant-level fuel consumption.[1] This step then deals with six plants for the final regulation, and ten for the proposed.

1/ The reader is referred to Appendix E which gives the data used for the first screening step.

Thus, in order to check their impact results, an effort was made to verify or correct the parameters being used in the first screening step, specifically the fuel consumption patterns of the plants as compared with those of the aggregate industry.

The results of this second screening step indicate that, for the final regulation, none of the six plants now expects to incur a price impact greater than one percent. Only the sulfuric acid plants warrant a detailed follow-up analysis, found in Section D.

For the proposed regulation seven of the twelve plants still would expect economic impacts. Although the two industries affected, cement and rubber, warrant a follow-up analysis performed on them, time constraints permitted only a follow-up on the industries affected under the final regulation.

d. Second Screening Step in Financial Impact Analysis

The industries which incurred the capital costs were isolated for examination of their financial position.

Next, the costs incurred by each plant were compared to the total annual capital expenditures of the companies which own the plants. This screening step revealed how many companies would suffer significant increases in investment demand as a result of each set of regulations. In most cases the percent of increase in expenditures at the corporate level was insignificant, an increase of over 1 percent was considered significant.

Corporate financial reports were examined for all companies which experienced significant impacts under either set of regulations and for which they were available. Sales, earnings and investment patterns were studied for indications of ability to finance the needed capital expenditures. Indication of possible effects of the regulations on some individual plants were obtained through conversations with air pollution control center staff members. Information about plant-specific investment considerations included plant age, existing pollution control equipment, and anticipated plans.

3. Detailed Methodology

a. First Screening Step

The following discussion elaborates on the parameters used in the first screening and their significance in the determination of the economic impacts.

As described, the energy consumption parameters were chosen in a conservative manner in order to render the first screening step thorough in identifying the impacted industries. For a few industries, determined to be energy intensive, and thus expected to possibly incur economic impacts, an attempt was made to obtain more accurate data from studies done specifically on each of the industries. These include the following:

Chemicals
Cement
Aluminum
Sulfuric Acid
Lime
Paper
Petroleum Refining
Steel

The reader is referenced to Appendix E for a summary of the energy parameters used.

b. Data Check and Recosting

This section describes in more detail the data comparisons outlined above.

In most cases, it was found that when the plants reported their fuel consumption to the Battelle data file, they neglected to report any other fuels than coal, even if they were burned in the same stack. Their omission leads to an overstatement of their stack emissions since coal causes higher sulfur emissions than a fuel mix. Also, there were significant discrepancies between the sulfur content of the coal that was being burned; in some cases Battelle's figures were high, some low.

The changes in emissions directly affect the control costs. For example, the cost of switching to a lower sulfur content coal depends on what the plant's base emissions are.

The quantity of fuels consumed varied significantly between the data sources. In most cases Battelle's coal consumption figures were high, overstating the control costs for both the use of a lower sulfur coal, and the use of an FGD.

Since the costing procedure was conducted at the stack level, the number of stacks is important in determining the least cost method of compliance. In all cases where there was a discrepancy in the count, Battelle's data apparently omitted some stacks. Their omission cannot be attributed to the absence of emissions since in all cases significant emissions were reported by Region data.

Thus there are data discrepancies between Battelle's file (Ohio EPA) and EPA Region V's file which are crucial to the determination of the compliance methods, their control costs, and consequently the economic impact. Revisions were made relying on the more recent data obtained by EPA Region V based on public comments received on the proposed regulations.

c. Second Screening Step in Price Impact Methodology

The only fuel typically affected by the regulations under consideration is coal. Therefore, it is necessary to find what percentage coal constitutes of the industry-wide energy figures. (The data used are in Table D-1).

In all cases, this percentage is small enough to indicate that the use of a total energy consumption to sales ratio would tend to overstate the expected price impact. This occurs because cost increases per million Btu related to coal were applied to all fuel consumption in the first screening step.

To remedy this, the industry-wide consumption data for these industries would be more reprentative of the plant's fuel consumption patterns. But, the most representative data is desired accounting for county-specific and/or state specific factors.

A check was made to see whether the industry in the state of Ohio or counties in Ohio are more coal intensive than the nation's industry. Therefore, with these considerations, the most applicable coal to total energy consumption fraction was applied to the total energy figure now being used. This gives a surrogate for the industry-wide coal consumption figure which reflects either Ohio's or the county's relative coal intensity. Using these data in the determination of the plant-level economic data will yield more accurate estimates of the economic impacts.

d. Second Screening Step in Financial Impact Analysis

The number of companies incurring capital costs of over 1 percent of annual corporate expenditures was determined by calculating the ratio of capital expenditures estimated to be required by the regulations to an average annual corporate expenditure figure. The corporate expenditure figure was derived by averaging the annual expenditures of the company for the years 1973 to 1975 as reported to the Securities and Exchange Commission. The average investment level for that period can be assumed to be relatively low due to the recession. Thus, the ratios can be expected to indicate impacts that are overstated. In several cases SEC stock reports gave long-term debt and equity information which could be compared to information about industry financing preferences or capabilities as stated in those reports or, in the case of the steel industry, the U.S. Environmental Protection Agency report; Economic Analysis of Proposed and and Interim Final Effluent Guidelines: Integrated Iron and Steel Industry (March 1976).

APPENDIX E

DATA SOURCES FO INDUSTRY WIDE SALES, CAPITAL EXPENDITURES, AND ENERGY FIGURES USED IN ESTIMATING PLANT LEVEL DATA

1. MANUFACTURING PLANTS
2. INSTITUTIONAL PLANTS

APPENDIX E

Data Sources for Industry Wide Sales, Capital Expenditures, And Energy Figures Used in Estimating Plant Level Data

The following discussion of the data sources for the estimation of plant-specific sales and capital budget information concentrates first on the derivation of industry specific dollar per production unit or energy usage ratio for manufacturing plants, and second on the budgets obtained for each individual institutional plant.

1. Manufacturing Plants

For the most part, industry-wide data for calculating dollar to energy use or production ratios was found in the 1972 Census of Manufactures. The data supplied by the 4 digit SIC codes are the annual capital outlays, dollar value of shipments for 1972, and purchased fuels and electric energy in billion kilowatt hours for 1971. (A discussion of adjusting for differences in the years involved follows later.) A number of industries were singled out as being particularly energy intensive and in several industries Census data did not include all energy usage. An attempt was made to obtain accurate data from studies done specifically on each of these industries.

o Chemicals (SIC 28) -- Data on the chemicals industry energy consumption was found in the Voluntary Industrial Energy Conservation progress report. The Manufacturing Chemists Association estimated that, in 1972, they consumed 3.065 quadrillion BTU's.[1/] Sales and capital expenditure data for 2800 was taken from the 1972 Census of Manufacturers.

o Cement (SIC 3241) -- The Portland Cement Association reported that in 1972, the industry consumed 7447 thousand tons

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[1/] Coal valued at 23.34 MMBTU's/ton. Energy report for the U.S. Portland Cement Industry, Summary Analysis, May 1975, p. 6.

of coal or 1.74 X 10^8 million BTU's.[1] In the east north central region, the coal consumption constituted 76 percent of total energy consumption for the industry, as opposed to 34 percent nationwide. Since the cement industry's energy use is more coal intensive in Ohio, the coal consumption figure was used as the normalizing factor. Sales and capital expenditure data was not supplied by the Association and was taken from the 1972 Census of Manufactures.

- Aluminum (SIC 3334) -- The energy consumed by the primary aluminum industry was 0.9 quads in 1972, as reported by the Aluminum Association, Inc.[2] As in the cases of the chemical and cement industries, Census data was used for value of shipments and capital expenditures.

- Sulfuric Acid (SIC 28193) -- Data for sulfuric acid plants (a portion of SIC 2819) was found in "Inorganic Chemicals" 1974 Current Industrial Report. Since no energy data was available for individual plants, the normalizing factor used was production in tons of sulfuric acid per day. The national sales and production figures for 1974 were $310,592 million[3] and 13,304,835 short tons, respectively. To determine the capital expenditures for the sulfuric acid industry, it was assumed that the ratio of value of shipments to capital expenditures for 28193 would be the same as that for 2819 given in the 1972 census data. The resulting 1974 capital expenditure for the sulfuric acid industry calculated by this approach is the $12 million dollars.[4]

1/ Coal valued at 23.34 MMBTU's/ton. Energy report for the U.S. Portland Cement Industry, Summary Analysis, May 1975.

2/ VIEC, p. 36.

3/ Current Industrial Reports. Inorganic Chemicals, 1974. Series M28A (74) - 14. Bureau of the Census, Dept. of Commerce. p. 4, table 4.

4/ 1972 census figures for 2819 are: Cap. exp. = $149.0 million; value shipments = $3,833.3 million.

- Lime (SIC 3274) -- The Minerals Yearbook was used to obtain some of the data for the Lime Industry (SIC code 3274). The lime industry consumed 136,241,160 million BTU's in 1973 and the value of the lime sold in 1972 was $341.08 million.[1/] The capital expenditures amounted to $39.4 million according to the 1972 census.

- Paper (SIC 2611, 2621, 2631, 2661) -- The paper industry was considered in four SIC code groups, namely:

(a) 2611 - Pulp mills

(b) 2621 - Paper mills, except building paper

(c) 2631 - Paper board mills

(d) 2661 - Building paper and board mills

The data used for energy consumption in the paper industry was reported by the American Paper Institute. In 1971, these four industrial classifications together consumed 2,205,509.8 billion BTU's.[2/] The energy figures for each of the four SIC codes separately were determined by using 1972 census data to determine what percentage of the total each consumed and applying these percentages to A.P.I.'s total. The results are:

(a) 2611 - 167,296.74 billion BTU's

(b) 2621 - 1,093,815.3 billion BTU's

(c) 2631 - 860,110.44 billion BTU's

(d) 2661 - 70,940.22 billion BTU's

The 1972 census was further used to obtain sales and capital expenditure data for these four industrial classifications.

[1/] 1973 Minerals Yearbook, Bureau of Mines, U.S. Department of the Interior Government Printing Office, pp. 716,18. (Energy valued at 3412 BTU's/kWh).

[2/] Unpublished data from API for 1971.

- Petroleum Refining (SIC 2911) -- The method to determine plant level data in the Petroleum Industry used crude runs to stills (or crude input) as the normalizing factor. This figure was found for the state of Ohio,[1/] and was divided by the crude distillation capacity for Ohio[2/] to determine capacity utilization for the state. This fraction, .83, was then applied to the crude capacity of each refinery in Ohio; yielding crude input for each. The Census of Manufactures of Ohio supplied the sales and capital expenditure values for the industry in the state.

- Steel (SIC 3312) -- The steel plants in Ohio are divided into those who will be subject to coke oven gas regulation and those with boilers. The plant specific data given is coke oven gas consumed for the former and coal burned for the latter, therefore we decided to have two different energy normalizing factors at the national level with which to estimate the plants' economic impacts. The American Iron and Steel Institute supplied 1975 figures. For coke oven gas burners, the energy figure to be used is the total coke oven gas consumed in 1975 by the steel industry. This is 852,373 million cubic feet.

For coal boilers, the Bureau of Mines reported that in 1975, steam coal consumption was 2,736,633 tons or 64,721,370 in BTU's.[3/]

Total sales were $33,214 million [4/] and capital expenditures were calculated by applying the average sales/capital expenditures ratio, taken over 4 years[5/] to the 1975 sales figure. The figure obtained is $1791 million.

[1/] 1974 crude runs to stills for Ohio = 178,798,000 barrels/year. Bureau of Mines, Mineral Industry, survey. Crude petroleum, petroleum products, and Natural-gas-liquids, 1974.

[2/] 2.1526×10^8 barrels = capacity of Ohio refineries as of Jan. 1, 1975; Oil and Gas Journal, April 7, 1975, p. 112.

[3/] Tons of coal valued at 27.65 MMBTU/ton. 1975 Annual Statistical Report, Bureau of Mines; American Iron and Steel Institute, 1976.

[4/] AISI 1975 data given during phone conversation, July 21, 1976.

[5/] This ratio fluctuates over time. Using the data from AISI, the average for 1972 to 1975 was 18.542 = sales/capital expenditure.

- Other -- The data for the remainder of the industrial classifications, that correspond to a specific plant type in Ohio, were all researched in the 1972 Census of Manufactures. Thus, the energy normalizing factor for the majority of the industries is the census value of purchased fuels and electric energy for 1971. When data was not available for the four digit classification, that for three and even two digits was substituted.

Adjustments must be made for the fact that the cost data on each plant were provided in 1975 dollars, and there is great disparity among the years for which the national data was collected. Consequently, commodity price indices were obtained from both the Bureau of Labor statistics and the Bureau of Economic Analysis to inflate the dollar figures to 1975 dollars. The BEA data was used only indices were not provided for four digit SIC codes in the BLS report. In this case, the figures are those provided by BEA for more general industrial classifications.

Similarly, the annual sales and capital expenditures were not generally found for the same year as the annual energy consumption or production. Annual industrial production indices, from the Federal Reserve Board, were used to expand or contract the energy data to correspond to the year for which the dollar data were given. By applying the production indices to energy data, we are tacitly assuming that energy consumption increases in proportion to production. The most disaggregated data possible were used, but for the majority of the industries, indices were supplied for three digit classifications only. In the cases where even this degree of specifications was not available, an average was taken of the data for those SIC codes with the same first two digits.

2. Institutional Plants

Table E-1 lists all fuel burning institutions in the state of Ohio, their Ohio identification numbers and total operating budget figures for 1975. Much of the budget information for hospitals, institutes, and medical facilities was provided by the American Hospital Association in its annual Guide to the Health Care Field (Chicago 1975). Medical institutions which were not in that guide were contacted individually; the 1975 budget listed for them is that which these institutions reported directly to EEA. The schools, with the exception of the public elementary and secondary schools, were contacted individually and provided the budget figures shown. The elementary and secondary school budgets were calculated using enrollment figures provided by their school systems and information from the State of Ohio Department of Education publication Costs per Pupil: School Year 1974-1975. Operating budgets for Prisons, Reformatories and Correctional Institutes were taken from the Ohio Department of Rehabilitation and Correction Annual Report for Fiscal Year 1975. A few government installations were contacted on an individual basis and reported their budget figures directly.

Table E-1

Budget Information For
Ohio Fuel Burning Institutions

Ohio ID #	Name	Budget ($1000's)
	Hospitals, Institutes & Medical Facilities	
02020256	Lima State Hospital	7,259
05010086	Athens Mental Health Center	6,312
18002009	Case Western Reserve Univ. Health Services	80,000
18004039	Cleveland Clinic Foundation	30,971
18004505	Polyclinic Hospital	3,836
18063522	V. A. Hospital	41,717
18590195	Highland View Co. Hospital	12,000
25040331	Correctional Medical Center	6,000
25040421	Columbus State Hospital	9,604
25040592	Grant Hospital	15,193
25042799	Columbus State Institute	11,701
31070132	Christ Hospital	21,014
31070207	Cincinnatti General Hospital	29,954
31140591	Longview State Hospital	11,028
42000171	Mt. Vernon	5,800
48010026	Mercy Hospital	13,927
48010037	Toledo Hospital	22,708
48010051	St. Vincent Hospital	25,283
48010247	Toledo Mental Health Center	10,383
48020002	St. Charles Hospital	8,237
57040304	St. Elizabeth Medical Center	18,413
65000010	Orient State Institute	20,500
974020170	Tiflin State Hospital	5,019
76000034	Molly Stark	1,737
76001045	Massilon State Hospital	8,879
77000004	Edwin Shaw Hospital	3,780
77000046	Hawthornden State Hospital	7,360
85000028	Apple Creek State Institute	8,721

Table E-1 (cont'd)

Ohio ID #	Name	Budget ($1000's)
Schools:		
05010016	Ohio University	
23010078	Ohio Weslyan University	12,000
25042612	Fairfield School for Boys	7,447
25043743	Capital University	10,274
29110097	East High School	1,549
31070849	Antioch College	16,000
45000018	University of Cincinnati	188,000
48010805	University of Toledo	42,775
52000010	Homerville Elementary School	210
52090003	Chatham Elementary School	142
67010000	Waterloo High School	601
67020005	Village Elementary School	606
67040085	Kent State University	64,153
67080000	Wait Elementary School	423
60108310	Alliance High School	1,866
77000023	Boston Elementary & Junior High School	219
87029240	Bowling Green State University	48,303
Prisons, Reformatories & Correctional Institutes		
49010062	London Correctional Institute	5,066
51010182	Marion Correctional Institute	5,240
70010282	Ohio State Reformatory	7,453
80010017	Ohio Reformatory for Women	2,587
Other (Government Installations)		
25000827	Rickenbacker AFB	15,661
29700175	Wright Patterson AFB	83,100
57040042	Defense Electronic Supply Center	51,020

TABLE E-2

Data Used For The Second Screening Step in The Price Impact Analysis

Industry	Data Base	Coal (in Thousands of Tons)	Total Energy (in Billion Kwh)	Ratio [3]
Primary Metals	Ohio Industry[1]	2907.4	103.3	.198
Paper	Ohio Industry[1]	1409.9	15.4	.643
Petroleum	Ohio Industry[1]	35.2	8.9	.028
Chemicals	Ohio Industry[1]	2265.5	30.8	.517
Rubber Products	Ohio Industry[1]	973.9	12.5	.547
	Canton SMSA [2]	14.3	.3	.335

1/ 1972 Census of Manufactures. Table 4. Quality and Cost of purchased fuels used for heat and power by state and industry group.

2/ 1972 Census of Manufactures Table 5. Quality and cost of purchased fuels used for heat and power by standard metropolitan statistical area and industry group.

3/ Coal evaluated at 23.96 MM Btu/ton. Energy evaluated at 3412 MM Btu/Kwh.

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APPENDIX F

INFLATION IMPACT STUDY DOCUMENTATION

This appendix identifies the documents prepared to support the Inflation Impact Analysis of the sulfur oxide regulations prepared by the U.S. Environmental Protection Agency (EPA) for the state of Ohio.

Figure 1 identifies the supporting documents. Document #2 provides an overview of the study methodology and illustrates the depth of analysis contained in the study.

Impact Studies

Documents #3 and 4 are economic impact analyses of the utility and industrial sectors in Ohio. These reports address impacts on prices, output, employment and financial viability. Document #5 summarizes the energy impacts of the regulation in terms of the level of energy demand, shifts from coal to oil likely to occur as a result of compliance with the regulations as well as shifts in coal production patterns. In particular, this report focuses on whether coal production in Ohio, which is generally high in sulfur content, will be adversely impacted.

Cost Minimization

Documents #6 and 7 present the methodology for estimating costs of compliance and the choice of pollution control strategies. For both utility and industry, these supporting documents outline the cost minimizing strategies which provide the basis for the economic and energy impacts discussed in documents #3 - 5.

Cost Inputs

These final documents contain the basic data inputs to the study. Document #8 describes the pollution control technology options, their costs plus basic plant specific parameters which influence costs such as fuel consumption and boiler firing rates.

Figure 1

INFLATION IMPACT STATEMENTS SUPPORTING DOCUMENTS

		#1 Inflation Impact Statement	#2 Study Methodology
IMPACT STUDIES	#3 Utility Impacts	#4 Industry Impacts	#5 Energy Impacts
CHOICE OF CONTROL STRATEGIES	#6 Utility Cost and Control Strategy	#7 Industry Cost and Control Strategy	
COST INPUTS	#8 Utility Data and Control Technology	#9 Industry Data and Control Technology	#10 Coal Prices

Document #9 contains similar data on the industrial sector. Document #10 presents the derivation of coal prices employed in this study and used in both the industry and utility sector analysis. The focus is on the price premium of low versus high sulfur coal.